UNIV. OF
TORONTO
LIBRARY

51530
1901

exposure to the solar radiation [1] have therefore been always a recognised part of the meteorological work of the Indian observatories, and, indeed, have received more attention, and have been more generally recorded, than is the practice at observatories of a similar class in European countries. But, notwithstanding that many precautions have been introduced in the use of these instruments, the temperatures shewn by them are so greatly dependent on the state of the atmosphere, that it is still a question whether it is possible to obtain from the registers any trustworthy indication of variations of the extra-terrestrial solar intensity. They afford a rough, comparative indication of variations in the amount of heat that reaches the earth's surface, itself a not unimportant datum in meteorological enquiry; and I have reason to believe that, when properly selected and discussed, the registers may afford indications of the greater fluctuations in the solar radiation, but this is the utmost that can be asserted at present.

An actinometer, such as that invented some years since by Professor Balfour Stewart, presents the advantages, that, in the first place, its measurements are, to a great extent, independent of surrounding terrestrial objects; and secondly, that it affords a measure of the quantity of heat received; not merely of a temperature, some of the conditions affecting which are variable to an unknown extent; but, like the sun thermometer, it indicates only the quantity of heat that has penetrated the atmosphere; and the great and variable absorption of solar radiation exercised by the atmosphere, which is the great difficulty in the way of determining variations in the radiation of the sun itself, affects the readings of the actinometer equally with those of the simpler instrument.

It has been thought that a country, such as India, would be eminently favourable for actinometric work, owing to the great preponderance of sunny over cloudy days which it affords. This, however, is not the case. Although clear days, as they would be entered in a meteorological register, are of frequent occurrence, and in the drier parts of India, even preponderate over those on which visible cloud is recorded, the haze, which is the almost constant accompaniment of fine dry weather, is as inimical to actinometric observations as actual cloud; and this haze is not only very variable in intensity, but, as a rule, extends to a height exceeding that of the Himalayan hill stations.

The actinometric registers that have been kept at the Alipore observatory for more than two years, although they may prove useful for meteorological discussion, will hardly, I expect, afford much direct evidence on the supposed variations of the sun's radiant energy. During the last year, Mr. J. B. N. Henessey has made, at Mussooree, some observations with the Stewart's actinometer, lent to him by this Department; and from a letter lately received from him, I learn that, at that hill station, even a visibly clear day is not very common; and this quite accords with my own experience at Simla. Some useful work may perhaps be done at these or other hill stations; but, at present, it would seem that we must go to much greater heights, or, at all events, take refuge in the clearer atmosphere beyond the great snowy range, in order to obtain conditions favourable for observations on the sun's radient intensity.

---

[1] It may not be superfluous to note here, in correction of a widely disseminated but most erroneous belief, that these observations are far from shewing the temperature of the sun, and that the question so frequently asked by persons unacquainted with the subject, "What is the temperature of the sunshine?" is one to which no definite answer is possible; since it entirely depends on the construction of the thermometer used, and on the nature and position of other objects surrounding it. A thermometer, the bulb of which is coated with lamp-black when exposed to sunshine, will acquire a much higher temperature than one with a naked glass bulb; and if the former be further enclosed in a glass tube from which the air has been exhausted, the temperature will again be increased by 30° or 40° in full sunshine. Again, if such a thermometer be placed in a small box lined with black cloth, the temperature shewn will again be raised many degrees, and, indeed, the theoretical limit of its temperature is no other than that of the sun itself, which far exceeds any terrestrial temperature that we are acquainted with. The temperature shewn by a thermometer exposed to sunshine is that at which, in each second of time, it radiates away to surrounding objects, exactly as much heat as the sun pours into it. The more this loss of heat is obstructed, the higher will be the temperature acquired.

The station of Leh having been selected for this purpose, on the recommendation of the Solar Physics Committee, the Secretary of State has been asked to send out a sapper, who has been selected by the Solar Physics Committee, and is now being trained in the work of observation at South Kensington. On his arrival, which it is expected will take place during the present season, he will be despatched to Leh, to commence work under the superintendence of Mr. Ney Elias, the British Joint Commissioner. An assistant, a native of India, will be provided, who may learn the work of observation during the two years, during which it is proposed that the sapper shall remain at Leh; and be prepared to carry it on after the latter's departure.

Apart from questions of Solar Physics, the heating power of the sun's rays at the earth's surface is, however, an important meteorological datum; and for this purpose alone, it would be well worth continuing the present system of actinometric measurement at Calcutta, and this will not be relinquished.

During the past year, sunshine recorders, for the purpose of registering the duration of sunshine, have been procured for the principal observatories, and one of these has been in use for some months at Allahabad.

RAINFALL STATISTICS AND MAP.—During the past year, some additions have been made to the list of the stations that regularly report rainfall to the Calcutta Meteorological office, by establishing rain-gauges at remote stations in the extreme south of the Mirzapur district, in the Tributary Mehals of Orissa, and in the eastern districts of the Central Provinces. An additional rain-gauge station has also been established in Rajputana; and steps are being taken by Dr. Hendley, the Residency Surgeon of Jeypore, to establish some others in the dry tract to the west of that station.

The new stations which have furnished registers for a portion of last year are—

Dudhi in Mirzapur	from	August	1881.
Partabgarh in Rajputana	,,	,,	,,
Charchika in the Tributary Mehals of Orissia.	from	November	1881.
Keonjhur ditto ditto	,,	December	,,
Angul ditto ditto	,,	November	,,
Saragaon in the Central Provinces	,,	,,	,,

Some others will appear in the rainfall lists of the year now current. Registers are also received from five additional stations in Mysore, *viz.*, Kolar, Tomkur, Chitaldrug, Chikmangalur and Hassan.

With reference to the remarks, made in the Report of last year, on the rain-gauges in use at certain stations in the North-Western Provinces and Bombay, I have lately learned that the Government of the former province have directed that Symons' gauges be supplied to the sudder stations not previously furnished with them; in Bombay, gauges of the same pattern were supplied generally to supersede the old and defective gauges in 1877.

The discussion of the rainfall statistics of India in past years has been continued, as far as has been practicable, in the intervals of more pressing work; but the progress made has been less than I had hoped; my time having been so much occupied with these latter duties that but little leisure has been afforded for the former special work. The scope of the work, as originally sketched out, has, too, been much extended by a resolution adopted in consultation with the Secretary to the Government of India in the Department of Revenue and Agriculture, and the Surveyor General, to draw up a large scale map of the rainfall of India; the data to be laid down, on a contoured map of India, which the Surveyor General has undertaken to prepare specially for the purpose. This, as regards the rainfall will involve the collection and reduction of all available rainfall registers, including those of sub-divisional and tehsildari stations, numbering altogether nearly 2,000 stations; and as the majority of them have been recorded only during 10 or 12 years or less, these latter must be corrected to values equivalent with those of the older registers, by factors deduced from the latter, and applied according to the geographical position of each station. The work is therefore very considerable; but the high importance of a trustworthy detailed rainfall map of India is such, that no labour bestowed on its preparation can be considered ill-applied. Some progress has been made in collecting and discussing the data, and I am in hopes that the whole may be ready, by the time that the new contoured map is ready for receiving them.

STORM-WARNING SYSTEM, CALCUTTA.—The improved form of daily report, illustrated by a chart, which was noticed in my report for last year, has been issued regularly from the Meteorological office of Bengal throughout the year. This requires the constant presence of a scientific officer; but in the cold season there is little difficulty in securing this, as the Meteorological Reporter for India can take over the duty when the Reporter for Bengal is absent in his inspection tours. During the Simla season, however, the work is very onerous and exacting; and in the event of Mr. Eliot being temporarily absent or disqualified by illness, it might be unavoidable that the report should be issued without chart or remarks; but this has not yet occurred.

During the past year, Mr. Eliot has devised a new and improved system of signals for the port and the signalling stations on the Hooghly below the port, which will afford more precise and detailed information, respecting the weather on the Bay of Bengal, than those hitherto in use. Our knowledge of storm phenomena on the Bay of Bengal has been so much advanced, in recent years, by the careful study of the storms of the Bay, that Mr. Eliot considers it practicable to distinguish between large and small storms, and, to a certain extent, to anticipate the course that they will follow; a matter of great importance to outgoing ships, as it will enable them to be prepared for veering or backing winds respectively. The new system of signals makes provision for this special information, and includes also general signals for indicating bad weather, when the actual existence of a cyclone is still in doubt. The system has lately been sanctioned by the Government of Bengal, and will shortly be brought into operation.

STORM-WARNING SYSTEM, BOMBAY.—This has been carried on during the last year on the system described in last year's report. Mr. Chambers does not publish any daily report; the information received is communicated to the Port Officer, and certain of the local newspapers are allowed to have copies, if desired. One useful piece of work performed by Mr. Chambers, in connection with the storm service, has been to draw up a list of the storms, of which he has found any recorded notice in published works or in the unpublished records of the observatories. He has found, or has himself recorded, notices of seventy storms in all, some of which have passed across from the Bay of Bengal; others were formed apparently on or near the west coast of India; and finally, some which appear to be land-formed storms, as far as can be judged from the meagre information available. As a first step towards the study of the storms of the west coast, the list is an interesting one, and I propose to publish it with a few additional notes in the Indian Meteorological Memoirs.

GROUND TEMPERATURES.—This important class of observations, which, as far as regards this department, was first set on foot in April 1878, has received an important extension during the past year. At the beginning of the year, they were recorded at two stations, Calcutta (Alipore) and Allahabad, by thermometers at the ground surface (or ½ inch beneath it) and at depths of one foot and three feet. Dr. Hendley, the Superintendent of the Maharajah's Observatory at Jeypore, commenced a series of similar observations in August, with thermometers at the surface, and buried one foot, three feet, and ten feet deep, to which has subsequently been added a thermometer at 20 feet deep. Mr. J. B. N. Henessey, M.A., F.R.S., of the Survey of India, has also commenced a series at depths of 1 foot, 3,2, 6,4, 12,8 ft. and 25,6 ft.; at the first three depths, with duplicate instruments. Abstract results of all these series will be published in the meteorological report for 1881, now in course of preparation.

FIRST-CLASS OBSERVATORIES.—Although the establishment of a first-class observatory at Allahabad can scarcely be said to be more advanced than at the date of my report of last year, the Maharajah of Jeypore's observatory has been rapidly organised as such, by the exertions of Dr. Hendley, and may be expected to be in working order in the course of a few weeks. As announced in my last report, any prospect of establishing a first-class observatory at Lahore must be regarded as a still distant possibility, and I therefore recommended that, in order to utilise the Van Rysselberghe's meteorograph, which had been procured from England for that station, it should be offered to the Maharajah of Jeypore, who was anxious to procure a similar instrument for his own observatory. The purchase having been sanctioned by Government, steps were immediately taken to construct a special building for its reception; and this is now ready, and the setting up of the instrument nearly completed. I have remarked, in my former report, that the situation of Jeypore in the dry, eminently continental climate of Rajputana, and on the border of the desert tract, is one, the detailed registers of which, recorded by so perfect an instrument as the Van Rysselberghe meteorograph, promise to be of the highest interest, and meteorological science will owe much to the enlightened liberality of the Maharajah of the State.

The delays at Allahabad have arisen out of circumstances unconnected with this Department, *viz.*, a proposal to establish an agricultural school at Cawnpore, and to remove the Meteorological Office of the N.-W. Provinces, and with it the proposed first-class observatory to that station. Pending the decision of the Secretary of State on this scheme, any further steps for establishing the Observatory must remain in abeyance.

EXTENSION OF OBSERVATORIES.—In the report for last year, mention was made of a proposal to establish observatories at Socotra and the Seychelles, if found practicable. The assistance of the Political Agent at Aden was solicited for this purpose and most cordially conceded. But as regards Socotra, the scheme proved to be impracticable, as there is no person resident on that island by whom the work could be undertaken with any prospect of success. With respect to the Seychelles, Mr. Meldrum, the Director of the Royal Alfred Observatory at the Mauritius, has for some time past received registers from a Government officer resident at Victoria, to whom he had supplied instruments; and the Chief Civil Commissioner recommended that the meteorological registration for this Department should be entrusted to the same person. Accordingly, the instruments and other necessary articles of outfit were despatched to the Seychelles, and duly reached the island; but, meanwhile, the officer who had agreed to undertake the work had died, and there has been some little delay in finding a competent successor. I have now just received information, through the Political Agent at Aden, that the duty has been undertaken by Mr. James Brodie, to whom the instruments have accordingly been made over; and the Chief Civil Commissioner having very kindly granted a site for the thermometer shed in the grounds of Government House, the instruments will be speedily set up, and Mr. Brodie expects to be ready to commence the work about the middle of June.

The observatory at Amini Divi was in working order during the whole of last year,—indeed since September 1880; but the registers having been sent to the Madras Office, from which they have not yet been transmitted to me, I am unable to form an opinion on the character of the work.

Mr. Hill has established two additional observatories in the outer Himalaya, at Pauri and Pithoragarh[1], and steps are being taken to obtain observations from stations in the interior of the mountain region, from which reports on the state of the snows may be obtained periodically. An additional observatory has also been sanctioned in Assam; but the station originally proposed—Gauhati—appears to offer no favourable site for the purpose; and the further consideration of the subject stands deferred, until one of the meteorological officers can visit Assam and select a suitable site.

One observatory which promised to become of great importance to the system, *viz.*, Gilgit in Cashmere, has been unavoidably relinquished, owing to the withdrawal of the resident European officers in July last. The loss is very greatly to be regretted, as it was working admirably, and the situation, far in the interior of the mountain region, and at the northernmost extremity of the Indian system, was such as to render the information, afforded by it, unique in value and kind. The observatory, established at Ootacamund on the Nilgiris, has also ceased to contribute registers. This observatory was established on the voluntary system in October 1879, on the application of Major Morant, R.E., and yielded excellent work. But, as is almost invariably the case with these voluntary observatories, no sooner had the founder left, than the work was found to be an unwelcome addition to the duties of the establishment. An observer's allowance on the usual scale was applied for, and, as the observatory had really been useful, was sanctioned by Government in October 1881. Meanwhile, however, the meteorological work had become an incubus not to be borne, and, notwithstanding the grant of an allowance, it was found that the work could not be carried on. It was therefore closed in March 1881. Such is usually, if not invariably, the result of volunteer observatories in India, when undertaken by persons who are not permanent residents.

MARINE METEOROLOGY.—The discussion of the data, extracted from the meteorological logs, in the possession of the London Meteorological Office has been deferred, until the arrival of a scientific assistant shall have increased the working strength of the office. The assistant, Mr. W. L. Dallas, who is expected to arrive in the course of a few weeks, has been instructed, with the permission of the Meteorological Council of the Royal Society, to learn the methods of work pursued, in reducing and discussing this class of data, in the London Meteorological Office; and the discussion of the data for Indian seas will be taken in hand as soon as possible after his arrival. Mr. Eliot has meanwhile made a preliminary examination of a portion of the data.

---

[1] The registers commenced in June and May respectively, 1881.

Mr. Eliot has also arranged for regular observations being made with verified instruments on the Government light-vessels stationed at the Sandheads, and in the intermediate channels of the Hooghly and Mutlah rivers; and has also obtained meteorological extracts from the logs of several vessels entering the port. Arrangements were in progress, during the year, to extend the collection of similar data, in a systematic manner, to all vessels that visit Calcutta. These have now been completed, with the assistance of the Port Officer, and the extended system came into operation at the beginning of the year.

CALCUTTA TIME SIGNALS.—The time ball on the top of the Port Commissioners' Office having been brought into working order, was dropped regularly at 1 P.M. mean, Calcutta time, from the 1st April 1881, in accordance with the announcement in the report of last year. At the same time, the service of the old time ball, on the semaphore tower of Fort William, was discontinued; and steps were taken to have it removed and replaced by the new ball and apparatus constructed by Messrs. Varley & Co. After some delay, this work was taken in hand and completed by the Garrison Engineer in January 1882. The electrical apparatus and the connections were then set up by the Electric Telegraph Department; but some further delay was incurred, by waiting for the construction of a new and much more direct line of communication between the observatory and the semaphore tower, and the new time ball was brought into use as a regular service, in conjunction with the Port Commissioner's time ball, after the close of the year under report, *viz.*, on the 8th May 1882.

At the same time that a new time ball was ordered for the semaphore tower in Fort William, an apparatus for firing the time gun by electricity was also ordered from the same maker. This consists of an induction coil, the primary current through which, from a local battery, is cut off by the action of the signal current, transmitted from the observatory; and the induction current, thus produced, fires the fuse of the time gun. On examination at the Electric Telegraph Workshops, the insulation of the coil was found to have fallen so low, in consequence, it is presumed, of the influence of the climate, as to render the apparatus unworkable; and the coil was accordingly sent home to be rewound, together with a report on its condition furnished by the electricians of the Electric Telegraph Department. On arrival in England, the coil was tested by the makers, and reported to have preserved its insulation perfect. It was rewound and returned to Calcutta, and having been again tested at the Electric Telegraph Workshops, it is found to be effective, the resistances reported being —

Primary coil	4·2 Ohms	Conductors.
Secondary	43·4 ,,	
Insulation of coils	22·03 Megohms.	

Meanwhile, arrangements have been made for setting up the gun-firing apparatus, close to the battery from which the time gun is fired. An empty expense magazine has been made ready for the purpose, and it is expected that the apparatus will be at work very shortly.

OBSERVATORIES.

The list of observatories in operation during the whole or part of the year ending 31st March 1882 is the same as that given at page 5 of the Administration Report for 1879-80, with the following additions :—

Three extra Indian observatories at Zanzibar, Aden, and Amini Divi (Lakadives) ;
One at Chowringhee, Calcutta, in connection with the Meteorological Office (4th class) ;
One private observatory at Jeypore ;
Two voluntary observatories at Pauri and Pithoragarh in Kumaon ;
A second-class observatory at Dhubri in Assam ;
And a third-class observatory at Darjeeling, which was established on the 1st October 1881, and will supersede the existing observatory at that station ;
A third-class voluntary observatory at Ghazipur, established in January 1881 ;

And the following deductions :—

Thull, on the Afghanistan frontier, abandoned in February 1881 ;
Ootacamund, relinquished in March 1881 ;
And Goalpara, which was abandoned in March 1881, the instruments being transferred to Dhubri.
The observatory of Gilgit was abandoned, as already mentioned, in July 1881, and was therefore in existence during a part of the year.

There were six additions to the list of stations in 1881 ; and three observatories, which had contributed registers during the whole or part of the preceding year, were struck off, making a net addition of three to the list for 1880-81, and raising the number of working observatories to 124. These were distributed in the different provinces as follow :—

Indian Empire.

Bengal and Assam	22
North-Western Provinces and Oudh	17
Punjab	11
Central Provinces	11
Berar	5
Central India and Rajputana	10
Bombay	14
Madras, Mysore, Coorg and Hyderabad	15
British Burma	8
Bay Islands	2
Lakadives	1
TOTAL	116

Extra Indian Settlements and Foreign States.

Nepal	1
Kashmir Territories	2
Beluchistan	1
Goa	1
Persian Gulf	1
Aden	1
Zanzibar	1
TOTAL	8

Of the whole number, two were first-class observatories, with instruments registering autographically ; twenty-four, (during the whole year), and two (during a part of the year), second-class observatories ; at all but two of which, in addition to observations at 10 hours and 16 hours, hourly readings are registered on four (or in some cases three) days in each month ; at all but one of these latter, synoptic observations are also registered daily, at 7 hours 10 minutes Washington mean time, (=18 hours 1 minute Calcutta mean time). The remainder, with four exceptions, are third-class stations, registering two full sets of observations, (and in the case of certain of the Madras stations, three sets) daily. The four excepted stations—Chowringhee (Calcutta), Mongpoo, Demagiri, and Makhla—register only temperature, humidity, rainfall, and wind direction. The observatories may be further classed as—

	Class.			
	1st.	2nd.	3rd.	4th.
Government observatories with paid observers under the Meteorological Department	1	24	80	1
Independent or attached to Government Offices, observers not paid by the Meteorological Department	1	0	7	4
Private and foreign observatories	0	2	4[1]	0
TOTAL	2	26	91	5

OBSERVATORIES IN BENGAL AND ASSAM.—*The Alipore Observatory.*—This observatory serves as a general depôt for the verification of instruments, as well as for observations of an experimental character; and an important part of its work is the control of the time signals for the port of Calcutta. It is immediately superintended by the Reporter to the Government of India ; and the establishment is under the immediate charge of the Chief Observer, Baboo Brojo Mohun Rukhit, B.A.

The work of the observatory consists of—

1st.—Continuous registration, by autographic instruments, of the atmospheric pressure, temperature, moisture (dry and wet bulb thermometers), wind direction, movement and pressure, and the rainfall.

2nd.—Periodical readings of the barometer, dry and wet bulb thermometers (including maximum and minimum), the rain-gauge and the actinometer, and estimates of cloud proportion. The temperature readings include those of the temperature of the air in shade, under a shed of the usual pattern, also in shaded cages at 4 feet and 40 feet above the ground ; those of nocturnal radiation and insolation, and those of the ground at the surface, and at 1 foot and 3 feet deep.

3rd.—The verification of all thermometers issued to observatories throughout India, with the exception of those under the Meteorological Reporters for Western India and Madras ; and the comparison of all barometers with the Calcutta standard.

4th.—The determination of the mean local time, by meridian observations of the sun, and the working of the time signals for the guidance of the shipping in the port.

The establishment, for these purposes, consists of—

Babu Brojo Mohan Rukhit, B.A.	Chief Observer.
,, Khetra Mohan Mukherjee	1st Photo. Asst.
,, Mahendra Nath Bhattacherjee	2nd Ditto.
,, Mahendra Nath Banerjee	Observer.
,, Shyam Lall Sen	Ditto.
2 Artificers.[2]	
1 Batteryman.[2]	
6 Servants.	

---

[1] Two of these were furnished with instruments by the Meteorological Department ; and at the close of the year one was brought on to the paid list.

[2] Employed for the time-ball apparatus.

The autographic instruments consist of a Kew barograph and thermograph, which register by photography, a Beckley's anemograph, an Osler's anemometer, and a Beckley's rain-gauge. During the past year, all these intruments have worked fairly well; excepting that the photographic traces, during the hot weather still fall far short of what is to be desired; and the irregularity of the results, under identical atmospheric conditions, lead me to infer that a part at least of the comparative failure is owing to want of care, cleanliness, and practical intelligence on the part of the assistants. Very few of the records have been absolutely lost; but the traces are frequently so much fogged that there is considerable difficulty in obtaining their measurements. The anemograph and rain-gauge, which record mechanically, present no difficulties, and give very satisfactory results.

The following table gives a comparative view of the mean results of the autographic registers of the barograph and thermograph, and of the eye observations of the barometer and thermometers recorded at the same hours. The standard barometer has the cistern about one foot higher than the barograph, and the standard thermometers are exposed under a shed open all round, while the bulbs of the thermograph are under a louvred pent-house, against the north wall of the observatory.

Comparative mean reduced readings of barograph and standard barometer in 1881.

	STANDARD BAROMETER.					BAROGRAPH.				
	6 hours.	10 hours.	16 hours.	22 hours.	Mean.	6 hours.	10 hours.	16 hours.	22 hours.	Mean.
January 1881 . .	30·053	30·127	29·997	30·062	30·060	30·056	30·136	30·004	30·073	30·067
February „ . .	29·987	·057	·917	29·997	29·990	29·991	·066	29·925	·006	29·997
March „ . .	·903	29·974	·840	·919	·909	·906	29·982	·853	29·926	·917
April „ . .	·739	·789	·656	·742	·732	·751	·801	·666	·752	·743
May „ . .	·685	·733	·617	·702	·684	·686	·741	·621	·708	·689
June „ . .	·542	·585	·496	·573	·549	·540	·587	·490	·577	·549
July „ . .	·529	·558	·474	·556	·529	·525	·562	·473	·557	·529
August „ . .	·594	·636	·539	·624	·598	·595	·643	·545	·632	·604
September „ . .	·685	·735	·623	·715	·690	·688	·749	·633	·725	·699
October „ . .	·809	·860	·752	·821	·810	·812	·871	·759	·830	·818
November „ . .	·933	·987	·865	·930	·929	·932	·995	·872	·943	·936
December „ . .	30·025	30·083	·950	30·026	30·021	30·022	30·092	·958	30·039	30 028
Year . .	29·790	29·844	29.727	29·806	29·792	29·792	29·852	29·733	29·814	29·798

Comparative mean readings of the thermograph and the dry bulb thermometer in the thermometer shed, in 1881.

	Thermometer in shed.					Thermograph.				
	6 hours.	10 hours.	16 hours.	22 hours.	Mean.	6 hours.	10 hours.	16 hours.	22 hours.	Mean.
January 1881 . .	54·2	67·7	75·2	58·6	63·9	55·8	66·3	74·0	59·7	64·0
February ,, . .	62·7	75·4	84·1	68·1	72·6	64·1	74·1	82·4	69·0	72·4
March ,, . .	68·3	79·7	85·2	72·8	76·5	69·4	79·2	84·7	73·8	76·8
April ,, . .	77·0	88·0	94·6	80·4	85·0	78·2	88·4	94·9	81·6	85·8
May ,, . .	78·1	86·8	89·3	79·9	83·5	79·1	87·5	89·7	81·2	84·4
June ,, . .	79·8	84·6	85·0	81·0	82·6	80·6	85·1	85·8	81·8	83·3
July ,, . .	79·8	83·8	84·4	80·9	82·2	80·6	84·8	85·3	81·7	83·1
August ,, . .	79·5	83·0	83·9	80·8	81·8	80·1	84·0	84·9	81·4	82·6
September ,, . .	79·5	84·7	85·1	80·1	82·4	80·2	85·3	86·2	81·1	83·2
October ,, . .	74·4	83·3	84·8	76·6	79·8	75·2	83·1	84·8	77·2	80·1
November ,, . .	64·1	76·0	80·8	68·1	72·3	65·4	75·1	79·9	68·7	72·3
December ,, . .	55·8	68·7	75·5	59·6	64·9	57·1	67·1	74·3	60·2	64·7
Year . .	71·1	80·1	84·0	73·9	77·3	72·2	80·0	83·9	74·8	77·7

Comparative mean readings of the thermograph and the wet bulb thermometer in the thermometer shed, in 1881.

	Wet bulb in shed.					Thermograph.				
	6 hours.	10 hours.	16 hours.	22 hours.	Mean.	6 hours.	10 hours.	16 hours.	22 hours.	Mean.
January 1881 . .	52·4	58·0	59·8	55·6	56·5	53·0	57·4	59·7	56·2	56·6
February ,, . .	61·1	65·7	64·6	63·8	63·8	61·6	65·5	65·4	64·3	64·2
March ,, . .	66·4	70·2	69·9	68·7	68·8	67·2	70·6	70·6	69·8	69·6
April ,, . .	75·4	77·5	76·7	77·1	76·7	76·0	78·4	77·8	78·0	77·6
May ,, . .	76·1	78·9	79·0	76·7	77·7	76·2	79·5	79·6	77·1	78·1
June ,, . .	78·6	80·1	80·1	78·9	79·4	79·0	80·8	81·0	79·4	80·1
July ,, . .	78·5	79·9	79·8	79·1	79·3	78·9	80·6	80·7	79·6	80·0
August ,, . .	78·4	79·6	79·8	79·1	79·2	78·7	80·4	80·8	79·4	79·8
September ,, . .	78·4	79·9	79·7	78·4	79·1	78·8	80·6	81·0	79·2	79·9
October ,, . .	73·5	75·8	74·9	74·7	74·7	73·9	76·3	75·7	75·1	75·3
November ,, . .	61·8	66·4	66·7	64·5	64·9	62·2	66·1	66·6	65·0	65·0
December ,, . .	54·0	60·6	61·6	57·4	58·4	54·4	60·0	61·7	57·6	58·4
Year . .	69·6	72·7	72·7	71·2	71·5	70·0	73·0	73·4	71·7	72·0

The above results are fairly accordant; but it is to be noticed that the excess of the barograph readings noticed in the later months of 1880 has characterised the whole of the year 1881. The cause of this is now under investigation. The slight differences of the thermometric tables are probably due to the unavoidable differences in the exposure of the instruments.

The readings of the Stewart's actinometer have been made on all clear days, as in the previous year, at *apparent* noon, and two hours before and after; the results, after reduction, will be sent home to the Solar Physics Committee, as were those of the year 1880-81.

The ground temperature observations have been steadily continued, the thermometers being read three times daily, at intervals of 8 hours; and, for one month, the surface and 1-foot thermometers were also read hourly between 5 hours 45 minutes and 21 hours 45 minutes, in order to obtain the curve of the diurnal variation. This series was made in March and April, *i.e.*, at the driest (and nearly the hottest) season of the year, when the diurnal range of temperature is greatest. Similar series will be made in the rainy season and the cold weather. The following table gives the results of the 8-hourly readings of the three thermometers and the monthly means, together with the mean air temperature for comparison:—

Mean temperatures of ground at Alipore in 1881-82.

1881-82.	SURFACE.			1 FOOT DEEP.			3 FEET DEEP.			MEANS.			
	5¾ hours.	13¾ hours.	21¾ hours.	5¾ hours.	13¾ hours.	21¾ hours.	5¾ hours.	13¾ hours.	21¾ hours.	Air in shade.	Surface.	1 foot.	3 feet.
April	78·9	108·4	82·8	84·8	85·0	86·2	83·2	83·3	83·3	85·3	90·0	85·3	83·3
May	80·7	101·4	83·0	86·7	86·8	87·3	86·1	86·2	86·2	84·1	88·4	86·9	86·2
June	82·6	93·1	83·8	86·3	86·3	86·6	85·9	86·0	86·0	83·4	86·5	86·4	86·0
July	82·4	92·8	83·8	86·2	85·5	86·4	86·4	86·4	86·3	83·0	86·3	86·0	86·4
August	82·3	92·0	83·9	85·3	85·3	85·5	85·6	85·6	85·6	82·5	86·1	85·4	85·6
September	82·5	95·1	84·4	86·0	86·0	86·2	86·2	86·3	86·2	82·9	87·3	86·1	86·2
October	78·2	91·2	80·6	83·3	83·6	83·6	85·5	85·5	85·5	79·7	83·3	83·5	85·5
November	66·1	82·2	70·2	75·8	76·3	76·4	80·9	81·0	80·4	71·9	72·8	76·2	80·8
December	57·6	75·5	61·5	68·3	69·1	69·0	75·3	75·7	75·4	64·2	64·9	68·8	75·5
January	61·0	76·1	64·6	68·8	69·2	69·7	72·9	73·2	73·2	67·1	67·2	69·2	73·1
February	63·7	81·4	67·7	71·6	71·9	72·4	74·8	74·9	74·9	69·3	70·9	72·0	74·9
March	73·4	99·7	78·3	79·0	79·1	80·1	78·8	79·0	79·0	79·4	83·8	79·4	78·9
Means . .	74·1	90·7	77·1	80·2	80·3	80·8	81·8	81·9	81·8	77·7	80·6	80·4	81·9

This table shows apparent anomalies of the same kind as those noticed in last year's report. The temperature at 3 feet deep is 4·2° in excess of that of the air and 1·5° above that at one foot deep.[1] At Allahabad, Mr. Hill finds similar differences. The cause of these remains to be explained.

---

[1] It appears from the results of the hourly observations mentioned above in the text that in the months of March and April the mean of the three readings at 8-hour intervals, differs from that of 24 hours by less than 0·1°. The mean of the 24 hours was obtained by interpolating, graphically, the readings for the interval of the night hours between 9 hours 45 minutes P.M. and 5 hours 45 minutes A.M. The mean surface temperature of the 24 hours, similarly obtained, is 0·2° only below that of the three 8-hourly readings.

The number of instruments, verified at the Alipore Observatory, during the year ending March 1882, is as follows:—

1. Barometers	22
2. Aneroids	7
3. Dry and wet bulb thermometers	22
4. Maximum thermometers for air temperatures	33
5. Minimum ditto ditto	33
6. Ditto ditto for nocturnal radiation	22
7. Solar radiation thermometers	33
8. Standard thermometers	1
9. Actinometers	3
TOTAL	176

An apparatus for the verification of thermometers (at temperatures above the freezing point) similar in construction to that originally devised and constructed for Kew, was received from England in August 1881. On removing it from its case, it was found to be injured, owing evidently to want of proper precautions in packing; and eventually it had to be taken to pieces and repaired at the Mathematical Instrument Department. It is now in good working order. Two simple contrivances for testing the freezing points of thermometers have been presented to the Observatory by Colonel Tennant, R.E., F.R.S., Mint Master of Calcutta.

The following is a summary of the instruments received and issued by the Observatory Store Department:—

	Received.	Issued.
1. Barometers	32	23
2. Aneroids	4	5
3. Dry and wet bulb thermometers	16	35
4. Maximum thermometers for air temperature	9	23
5. Minimum ditto ditto	16	30
6. Ditto ditto for nocturnal radiation	54	50
7. Standard thermometers	1	1
8. Solar radiation thermometers	58	32
9. Actinometer (Stewart's)	0	1
10. Anemometers	16	23
11. Anemoscopes	1	0
12. Hygrometers (Regnault's)	0	1
13. Sunshine recorders	1	1[1]
14. Apparatus for testing freezing points	2	2[1]
15. Ditto ditto thermometers	1	1[1]
TOTAL	211	228

The consumption of instruments at the different observatories will be shewn in a tabular form in another section of the report.

The time signals were given, during the whole of the year, with the new time ball constructed by Messrs. Varley, and set up on the roof of the Port Commissioner's office. The ball dropped accurately on 279 days. Of the remainder, 76 days were Sundays and public holidays, on which the signals are not given; and on 10 days the signal was either inaccurate or incomplete, or failed entirely—failures which were, in the majority of cases, traceable to some imperfection in the communications. The following is a detailed list of the failures:—

---

[1] These instruments issued for use in the Alipore Observatory.

Dates of failure.	Nature of failure.
11th May 1881 . .	Telegraphic communication out of order; ball not hoisted.
10th October „ . .	The ball failed to give the return signal confirming its accuracy.
20th „ „ . .	Ball did not drop at the usual signal.
7th November „ . .	Telegraphic communication out of order; ball not hoisted.
9th „ „ . .	Ball dropped about 1·5 seconds after 1 P.M.
18th „ „ . .	Ball did not drop at the usual signal.
29th December „ . .	Ball dropped about 36 seconds after 1 P.M.
6th January 1882 . .	Ball did not drop at the usual signal.
7th „ „ . .	Ball dropped about 3 minutes 15·25 seconds before 1 P.M.
27th March „ . .	The ball failed to give the return signal confirming its accuracy.

These failures are less, by three, than in the previous years, the lines of communication being fully a mile longer and the completion of the signal depending on the integrity of two lines instead of one. Moreover, the duty of hoisting the ball and setting the trigger is performed by the servants of the Port Commissioner's Office, not by the more experienced servants of the Telegraph Department.

The service of the old ball on the semaphore tower in Fort William was discontinued on the 1st April 1881. Some delay was incurred in removing the old ball and setting up the new ball and apparatus; (the duplicate of that in use at the Port Commissioners); and the apparatus was not completely set up before the 16th January 1882. Even then it could not be brought into use, pending the completion of a new and direct line of communication between the observatory and the Fort. This was not reported ready until the 27th April, after the close of the year under report, and the service was resumed on the 8th May. The arrangements for firing the gun by electricity were completed still later. In the introduction, I have already detailed some of the causes which have delayed this improvement.

OTHER OBSERVATORIES IN BENGAL AND ASSAM.—During the whole or part of the year there were seven observatories of the second class, eleven of the third class, and three of the fourth class in Bengal and Assam; but, of these, the second class observatory at Dhubri has been substituted for that of Goalpara, which was included in the report for last year; and two of the third class were co-existent at the same station (Darjeeling); the observations being made simultaneously at the new and old observatories, in order to obtain the difference of their average conditions.

Second Class.

Sibsagar.
Dhubri.
Patna.
Hazaribagh.
Saugor Island.
Cuttack.
Chittagong.

Third Class.

Darjeeling (E. T. Office).
Ditto (St. Paul's School).
Purneah.
Durbhànga.
Gya.
Berhampore.
Burdwan.
Dacca.
Silchar.
False Point.
Jessore.

Fourth Class.

Demagiri.
Mongpoo.
Calcutta (Chowringhee).

At stations of the second class, excepting Saugor Island, hourly observations are recorded on four days in each month, and also synoptic observations, which are taken daily at 18h. 1m. Calcutta mean time, for communication to Chief Signal Officer, Washington, as part of the International Series of Synoptic Observations. Full sets of observations are also recorded daily at 10 A.M. and 4 P.M., as at stations of the third class; and, at Saugor Island, also at 10 P.M. and 4 A.M., in lieu of the hourly observations of the other observatories. At Chittagong and Saugor Island, the wind direction and movement are recorded continuously by Beckley's anemographs. At Hazaribagh, Dhubri, and Cuttack, embossing anemographs of Casella's pattern are in use, that at Dhubri having been set up on a tower erected for the purpose, and brought into use on the 18th March 1882. A similar instrument originally intended for the Patna observatory has been transferred to Darjeeling.

Mr. Eliot's report (Appendix A) states that two of the second-class observatories, *viz.*, Dhubri and Patna, have been inspected during the year, the former by Mr. Eliot himself, the latter by Mr. A. Pedler, who officiated for him during three months of the last cold season. The Dhubri observatory was not completed at the time of his visit, the anemometer tower not having been built. In its imperfect condition it was, however, in very good order. The position is favourable, and the observer is careful in his work. The assistant observer was in charge at the time of inspection, the observer being on leave.

Of the Patna, or rather the Bankipore, observatory, inspected on the 26th February, Mr. Pedler's report, endorsed by Mr. Eliot, is less favourable. Some of the instruments afforded evidence of neglect; and the observer appears to be somewhat careless in his work. Mr. Eliot reported to a somewhat similar effect in the previous year; and he suggests that, if a change for the better does not take place, it may be advisable to reduce Patna to an observatory of the third class. In this suggestion I am disposed to concur; the more so that the site of the observatory has been changed, and the observations are no longer taken under the same conditions of exposure as formerly. In May 1883, the hourly observations of ten complete years will be available, and it may be a question whether a portion of the money now spent on this observatory may not be turned to better account elsewhere.

Of the remaining observatories of this class, Mr. Eliot reports—"The Saugor Island and Cuttack observatories are the best of my second-class observatories, and have worked satisfactorily during the whole year. Dhubri and Chittagong came next in order of merit. Sibsagar is nearly equal to the last two in character, so far as I can judge by the returns. I regret I have been as yet unable to visit that station. The remaining two, Hazaribagh and Patna, are not at present as satisfactory as they ought to be.

Both send in returns with numerous mistakes, and the returns are usually not received until considerably after the proper time; so much so as to occasionally delay the publication of the monthly abstract. I regret to say that I have found it necessary to fine both observers for delay during the past year."

At Darjeeling, a new observatory of the third class has been established at St. Paul's School, on the crest of the Jallapahar ridge, which, after a year's observations shall have been recorded at the new and old sites simultaneously, will supersede the existing observatory at the Electric Telegraph Office. The reasons for this removal were explained in my report for 1880-81 (p. 19). The situation of St. Paul's School, on the crest of the ridge (209 feet higher than the Electric Telegraph Office), is one eminently favourable for wind observations—a point in which, with the exception of Chakrata, the hill observatories are somewhat defective; and the anemograph, originally intended for Patna, has therefore been transferred to this observatory. The site has also a certain historic interest in connection with the meteorological statistics of the station, as it was here that Dr. Joseph Hooker (now Sir J. Hooker) recorded his observations in 1848-49; the house being at that time the residence of the well-known naturalist and ethnologist, Mr. Bryan Hudgson, F.R.S. The observatory was opened on the 1st October 1881, and was visited by Mr. Eliot on the 20th and 21st November. Mr. Eliot does not state specifically the actual condition of the instruments; but his confident assurance that he believes the observations will be of a high order for accuracy and value, sufficiently expresses his satisfaction with its condition.

Three other observatories of this class were inspected during the year by Mr. A. Pedler, *viz.*, Burdwan, Jessore, and Berhampore. Of the first and last of these, the reports are very favourable; as indeed has been the case in previous years; and the observers at both these stations have been selected as recipients of the special allowances, sanctioned last year by Government, for meritorious observers. Mr. Pedler's report on the Jessore observatory is less favourable. The observer, who has been employed in that capacity for many years, and was originally trained in Calcutta, is quite competent to do his work well, but appears to be very careless, and his instruments shewed many indications of neglect.

Of the remaining third-class observatories, Dacca and False Point, both under the care of the Telegraph Masters, are, as judged from the returns, nearly, if not quite, equal to Burdwan and Berhampore. Durbhanga, Gya, and Jessore follow next in order of merit; while the work of the Silchar and Purneah observatories, during the past year, is not at all satisfactory; and the registers sent in from these stations are always open to a suspicion of want of accuracy. Unfortunately, they, and more especially Silchar, are not very readily accessible, and it is now more than three years since this latter observatory was inspected. It is, however, an important station, as representing the climate of Sylhet and Cachar; and an endeavour will be made during the ensuing season to visit it and the other stations in the Assam province, and to introduce the reforms so urgently required.

Of the three observatories of the fourth class, one, Calcutta, (Chowringhee) is attached to the Meteorological Office, and is always under inspection; that of Mongpoo is a voluntary observatory, situated at the Government cinchona plantations below Darjeeling, and is quite trustworthy. The third, at Demagiri in the Chittagong Hill

Tracts, is also a voluntary observatory, of which nothing more can be said than that there appears to be no reason to question the validity of the registers.

Observatories in the North-Western Provinces and Oudh.—Three additional observatories have been established in these provinces during the past year, by the Meteorological Reporter, Mr. S. A. Hill, B.Sc., all of the third class; and they are now represented by seventeen observatories, classed as follows:—

Second Class.

Allahabád.
Agra.
Lucknow.
Roorkee.

Third Class.

Chakrata.
Ranikhet.
Mussooree (St. Fidelis)
Ditto (Surveyor General's Office).
Dehra.
Bareilly.
Meerut.
Gorakhpur.
Benares.
Jhansi.
Pauri.
Pithoragarh.
Ghazipur.

All the observatories of the second class contribute registers of the same character as stations of the same class in Bengal; and Allahabad, which is only provisionally retained in this class, pending the provision of a permanent building for an observatory of the first class (with autographic instruments), furnishes several additional observations. These are, readings of all (except self-registering) instruments, at 4 A.M. and 10 P.M.; making, with the ordinary sets at 10 A.M. and 4 P.M., four sets of observations, at equal intervals of six hours; observations of ground temperature, taken under conditions similar to those at Alipore, at depths of ½ inch, 1 foot, and 3 feet; also the traces of a King's barograph, and an occasional record of the movement of the clouds, by means of a nephescope, similar in pattern to that of the Montsouris observatory.

An abstract of the results of the observations of the ground temperature is given by Mr. Hill, in the Appendix to his report, (Appendix B II), from which it will be seen that, at Allahabad as at Calcutta, the temperature of the ground exceeds that of the air by several degrees, and, moreover, that at 3 feet deep is higher than at 1 foot deep.

As regards the proposed removal of the Allahabad observatory from its present temporary position at the private dwelling-house of the Meteorological Reporter to the site selected for it at the new Muir College, Mr. Hill reports that the building has not yet been commenced. Plans have been drawn and sites chosen, again and again, but still no progress has been made; the last cause of delay being a reference to the English architect who designed the Muir College, and who objected to any addition not designed by himself. Meanwhile, as the present temporary site must be vacated before long, a thermometer shed has been erected near the College, and, from the beginning of the current year, observations have been made there simultaneously with those at the present observatory, in order to shew how the temperature registers will be affected by the removal of the observatory.

Mr. Hill adds—"It is possible that, after all, the first-class observatory may not be erected at Allahabad but at Cawnpore . . . . "; but, in any case, the

Allahabad observatory will be maintained on its present or a reduced scale, and the temperature comparison, now instituted, will therefore not be lost.

The remaining second-class observatories were all inspected during the year, either by Mr. Hill or by Mr. Boutflower, who temporarily officiated for him. Roorkee was visited in May by Mr. Boutflower, Lucknow by Mr. Hill in June, and Agra in December. No details are given in his report; but it is remarked that "neither I nor Mr. Boutflower found much to complain of in the general condition of the observatories we visited; the instruments being, as a rule, clean and in good order." The error of following Madras (or railway) instead of local time, which, last year, was found to prevail at some of the observatories, has been eradicated.

Lucknow and Roorkee alone are provided with anemographs, both of Beckley's pattern. That at Roorkee is reported to have worked thoroughly well, and the traces of two years now await measurement and tabulation. That at Lucknow had been set up in a very unsuitable position, as was noticed in my report for last year. It has now been removed to the position which I selected for it when visiting the observatory in November 1880; and since the 7th August, 1881, when it was again set to work, it has worked admirably.

The thirteen observatories of the third class furnish registers of the same character as those afforded by the observatories so classed in Bengal, and indeed all other provinces (excepting Madras). Only six were provided with observers, paid by the Meteorological Department. Of the remainder, two are carried on in connection with the offices of the Survey of India at Mussooree and Dehra, respectively, (at the first during the summer season only); a third is established at St. Fidelis' School, Mussooree, at a much lower elevation than the survey office, and the observations are recorded by the masters, under the Rev. Fr. Genesius, S. J., the Principal of the school; a fourth, that of Meerut, is carried on at the expense of the Municipality of that city; a fifth is established in connection with the opium factory at Ghazipur; and the remaining two were established, on the voluntary system, at the Himalayan stations Pauri and Pithoragarh, in June and May 1881, respectively. At the former, the work has been undertaken by the Rev. J. T. McMahon; at the latter by the Rev. Dr. Gray, the instruments being supplied by this Department.

The observatories of Ranikhet, Pauri, Mussooree (St. Fidelis), Chakrata, Bareilly, and Benares were visited, during the year, by either Mr. Hill or Mr. Boutflower, and are subject to the same remark as that quoted above, with reference to the second-class observatories. On the occasion of his visit to Mussooree, Mr. Hill determined the exact elevation of the barometer cistern at St. Fidelis' School, by running a line of levels to a G. T. S. bench-mark, in the immediate neighbourhood. Thus a very important datum has been supplied, which was wanting previously.

The observers at the second-class observatories, Allahabad, Agra, and Lucknow, and at the third-class observatories, Chakrata, Ranikhet, and Benares, have been selected for the special allowances recently sanctioned for meritorious work.

Some further details are given in Mr. Hill's report (Appendix B I).

OBSERVATORIES IN THE PUNJAB.—The number of observatories in the Punjab is the same as at the close of the previous year, *viz.*, eleven, all under the Reporter to the

Government of the Punjab, whose Administration Report will be found in Appendix C. They are classed as follows:—

Second Class.

Lahore.

Third Class.

Mooltan.
Dera Ismail Khan.
Peshâwar.
Rawalpindi.
Sialkot.
Murree.
Ludhiana.
Simla.
Delhi.
Sirsa.

It was originally intended to raise Lahore, as well as Allahabad, to the status of a first-class observatory, provided with autographic instruments; and a Van Rysselberghe meteorograph was obtained from Europe for its equipment. But, in the first place, the position of the existing observatory at the Mayo Hospital is far from suitable, and in the second place it would be useless to set up such an apparatus in the absence of any skilled artisans, or of a superintending officer with practical experience in the use of delicate physical apparatus[1]; and as there is now but little prospect of the services of any such officer or establishment being available in Lahore, the scheme of establishing a first-class observatory at this station has been for the present abandoned; and the Van Rysselberghe has been otherwise disposed of. Lahore, therefore, continues to work as a second-class observatory; furnishing, however, observations at four 6-hourly intervals, on all days, in addition to the hourly observations on four days in each month.

The majority of the Punjab observatories have been inspected twice during the past year. All, with the exception of Dera Ismail Khan and Mooltan, were visited by Dr. Lawrie, the Meteorological Reporter to the Government of the Punjab, in August and September 1881; and, excepting Simla and Lahore, all were again visited by Mr. Eliot, when officiating for me, as Meteorological Reporter to the Government of India, from December 1881 to February of the present year. Mr. Eliot verified the barometers of all the observatories inspected.

Of the Delhi observatory, Dr. Lawrie remarks that, with the exception of a slight error in the construction of the thermometer shed, the insecure fixing of the anemometer, and a few trifling defects which were remedied during his visit, everything was in fair order, and the records were well kept. Mr. Eliot found the thermometers all clean and in good order, with the exception of the nocturnal radiation thermometer, which seemed to be somewhat faulty in action. The wind vane was tested and found to be correctly placed; the anemometer in good order and working fairly, but rather dirty. He reports that the Assistant Surgeon, who is the observer, is intelligent and fully competent. The only points to which it was necessary to direct his attention, were a more careful adjustment of the fiducial point of the barometer and the occasional dusting of the anemometer. A stronger ladder also was required to give access to the anemometer.

At Sirsa Dr. Lawrie "found all the instruments, except the rain-gauge, in good order. The anemometer was in a wrong position on the top of the (thermometer) shed," and was directed to be removed to the top of the Jail Office. "The rain-gauge was out of order, and was replaced by a new one," and a number of petty repairs were effected during Dr. Lawrie's visit The thermometer shed was in a "most tumble-down" condition, and was condemned. It appears from Mr. Eliot's report that, at the date of his visit in the beginning of January, the condition of the thermometer shed and wind vane were the same as at the time of Dr. Lawrie's visit. He says, "The observatory shed is very old and certain to tumble down during the first high wind," and "the anemometer and wind vane are placed on the top of the main post of the observatory shed and approached by a ladder, . . . so unsafe, that I was unable to examine the instruments thoroughly." He also condemns the position of the shed as being too near the ice-pit; and he recommends its reconstruction in a neighbouring position, offering a similar exposure, on a site the occupation of which had been sanctioned by the Deputy Commissioner. Dr. Lawrie reports that the shed has since been reconstructed on the site recommended by Mr. Eliot.

---

[1] It will be seen from a remark in Dr. Lawrie's report (Appendix C) that he thinks the meteorograph would probably have been of great service at the Lahore observatory; and in this opinion I should have concurred, could I have thought it probable that it would have worked successfully. But a practical experience of the working of the instrument for some months in my own office at Calcutta has led me to a negative conclusion. In the Maharajah's observatory at Jeypore, where a building has been erected specially for its reception, and where the assistance of skilled artisans is always available, I think this beautiful instrument will be under far more favourable conditions.

The observatory had never before been visited by any Meteorological Officer, and hence probably its somewhat neglected condition. Of the observer, Mr. Eliot reports very favourably. He says, "The thermometers were all clean, well kept, and in good order. The observer reads the instruments carefully and accurately; and when a proper shed has been supplied, I am quite sure the Sirsa observatory will supply accurate and trustworthy observations, and take a high place among our Indian observatories."

At Ludhiana, Dr. Lawrie found all the records, instruments, shed, &c., in good order. The Assistant Surgeon (who is also the observer) is a man of intelligence; but his clock was not going at the time of Dr. Lawrie's visit, and he was unable to explain how, under these conditions, he managed to take his observations punctually. Apparently at the time of Mr. Eliot's visit in December, all causes of complaint had disappeared. The only improvement which Mr. Eliot had to recommend was, that the barometer should be fixed, instead of being allowed to swing freely. Both the instruments and the buildings were in thoroughly good order, and the observer appeared to take the observations intelligently and carefully. His report concludes—"I am perfectly satisfied with the condition of this observatory."

The Simla observatory was visited by Dr. Lawrie, and also by myself during the Simla season. My own experience is to the same effect as Dr. Lawrie's, *viz*, that the instruments are well kept, clean, and in good order. The difference of level between the present site (at Bairdville) and the former site (at Portmore) has been determined by levelling during the past year.

Sialkot was visited by Dr. Lawrie in September, and by Mr. Eliot in December, 1881. The position of the observatory is faulty in some respects, and, at the time of Dr. Lawrie's visit, the ladder for giving access to the wind vane (anemometer?) was in so dangerous a condition as apparently to lead the reporter to entertain some doubt whether it was really used. This appears to have been remedied at the time of Mr. Eliot's inspection. Mr. Eliot found the instruments very clean and in capital order, the barometer well placed and in thoroughly good condition; and the wind vane and anemometer in satisfactory order, clean and well oiled. The rain-gauge appeared to be somewhat injudiciously placed, and the minimum thermometer did not work well, but with these slight exceptions, everything was satisfactory; and the Assistant Surgeon, who is the observer, is thoroughly and intelligently acquainted with the work of observation.

The reports on the Rawalpindi observatory are much less satisfactory, and the registers for the past year afford indications of serious neglect, in addition to those noticed by the inspecting officers. Dr. Lawrie states, indeed, that the thermometer shed was well built, according to pattern and in good order, but the instruments were neither well kept nor clean. The wind vane stand was also not firm. He adds—"The observer at this station gave much trouble during the year and neglected to maintain accuracy in his observations."

Mr. Eliot found the barometer clean and in good order, but the observer was unable to set and read the instrument properly; the thermometers were, however, in good order Mr. Eliot considers the readings of the barometer, hitherto recorded by this observer as worthless; and this condemnation is borne out by the results of comparison with those of Murree and other stations. Moreover, the readings of the hygrometer from April to August 1881, inclusive, are in great part worthless, as was detected when the registers came into the hands of my own office.

The Murree observatory, on the other hand, is reported on in the most favourable terms. Dr. Lawrie found it, as it invariably is, "in capital order, and all the records and observations kept with great care and neatness." And Mr. Eliot's testimony is to a similar effect: "The observatory shed is capitally placed on the crest of a hill; the thermometers are in thoroughly good order . . .; the barometer is placed in the office room, with a good side light; . . . . the anemometer, wind vane and rain-gauge are all in good order and properly placed. The observatory is altogether in a very satisfactory condition and reflects great credit on the observer; [Mr. Johnson succeeded by Mr. Cruikshanks]." very much of this very satisfactory state of things is certainly due to the exertions of the Superintendent, the Reverend Mr Peak, also Principal of the Lawrence Asylum.

The reports on Peshâwar are also favourable, as far as they relate to the work of the observer. In the equipment of this observatory, as well of that of many other stations, several matters were found susceptible of improvement. Dr. Lawrie says, "I found the records kept very neatly. The observer has given satisfaction during the year by the accuracy of his observations. I found the shed small and not made according to pattern. The barometer was an old one and kept in the verandah, &c. . . . . . A new barometer was supplied and all the defects noticed remedied, except that a new shed has not hitherto been put up."

Mr. Eliot also condemns the shed, and the position of the barometer in the verandah, which is in infraction of the official instructions. The barometer has since been placed inside. He reports: "The instruments are all in very good order, perfectly clean and in satisfactory condition." "Generally, I am thoroughly satisfied with the condition of the observatory; and when the improvements suggested are effected, it will be one of the most valuable observatories in the Punjab. The observer takes the observations accurately and carefully, and records them very neatly."

The observatory of Dera Ismail Khan has never been visited by any reporter before Mr. Eliot's visit, although it is one of the oldest observatories in the Punjab. In the time of the late Meteorological Reporter to the Government of the Punjab, the only inspection ever attempted was by one of the clerks of his office. It is, therefore, a matter of congratulation that the defects found by Mr. Eliot were only such as indicate a very ordinary degree of neglect. The barometer, an old one, was in fairly good condition; and the observer read it correctly, but with difficulty, owing to the bad illumination. The thermometer shed was very dirty; the instruments generally in order, except that all were covered with dust, and the wet thermometers coated with encrustation. The wind vane and the anemometer were in good order, but dirty. The observer was found to read his instruments quite correctly.

Lastly, the observatory of Mooltan was inspected by Mr. Eliot in December; it was last visited by Dr. Lawrie in 1880; and had also been inspected by Mr. Eliot in January 1879, and by myself in April 1875. It was formerly one of the least satisfactory in the province; but Mr. Eliot's report is generally very favourable, some little details only requiring correction; such as that the barometer was allowed to hang loosely, the solar thermometer was wrongly inclined, the wind vane was not firmly fixed; and it was the practice of the observer to read his thermometers only to whole degrees. The records were in good order and kept up to date; and the condition of the observatory good. The observer was unwell and absent at the time of Mr. Eliot's visit.

As the general result of the inspection, the observatories in the Punjab shew a considerable improvement on the condition presented by them a few years back; but something still remains to be done, and it is only by dint of frequent inspection and careful examination of the registers, that such observatories as that of Rawalpindi can be brought up to the required standard. The practice on the part of the observers, of handing over the work to one of their subordinates, to which Dr. Lawrie has drawn attention, both in the present and in last year's report, is, no doubt, the cause of much bad work; but this practice will not be suppressed by increasing the allowance to the observers; nor, I fear, will the character of the work be materially inproved by requiring them to certify that the readings have been recorded by themselves personally. The latter measure, in so far as it may tend to the suppression of vicarious work by untrained subordinates, will, probably, only foster unpunctuality and therefore inaccuracy. The fundamental error appears to me to be in the system adopted in the Punjab, which requires the observations to be registered by men, who practise privately for remuneration, and whose personal interests therefore are likely to clash with the requirements of the work. Increasing the allowances of such men will not induce them to sacrifice any of their private practice; and the remedy is to be found in entrusting the work to men who have no such direct inducement to neglect it. But no measures of this kind are likely to be successful unless the observatories are frequently inspected; and unless the Meteorological Reporter works personally at the data sent in by his observatories, thus placing himself in a position to detect inconsistencies and physical impossibilities. Under Dr. Lawrie's superintendence,—that is, during the last two years,—the Punjab observatories have been assiduously visited; but there is but too much reason to believe that the meteorological work of the Punjab observatories has not always received that amount of attention on the part of the local reporter, that was indispensable to keep the observers up to the work; and the observatories are still suffering in some measure from this past neglect. It will be the work of time and assiduous attention on the part of the controlling officer to place matters on a healthy footing; some changes of system may be found necessary; but the favourable reports of many of the observatories contributed by Mr. Eliot shew that no sweeping changes are necessary, and that if much remains to do, much has already been done.

The nominal list of superintendents and observers at the Punjab observatories is given in the return appended to Dr Lawrie's report (Appendix C II). The observers at Peshâwar, Mooltan, and Sirsa have been selected for the special allowances granted for meritorious work.

OBSERVATORIES IN THE CENTRAL PROVINCES.—These are eleven in number, as in previous years, *viz.,* three stations of the second class and eight of the third class :—

Second Class.

Nagpur.	Jubbulpore.	Pachmarhi.

Third Class.

Saugor.	Chanda.
Hoshangabad.	Sironcha.
Seoni	Raipur.
Khandwa.	Sambalpur.

The detailed report on the condition of the observatories in the Central Provinces, drawn up by Dr. B. Simpson, the Deputy Surgeon General of the Province, will be found *in extenso* in Appendix D.

The work of the Nagpur and Pachmarhi observatories has been satisfactory. Nagpur is the only observatory that has been inspected by the Deputy Surgeon General, who, in conjunction with the Meteorological Reporter for India, administers the meteorological work of the province; and this was found to be in the same excellent condition as at the time of my own inspection in the spring of 1880.

The objectionable proximity of the new anemograph tower to the old platform on which are set up the wind vane and small anemometer, noticed in Dr. Simpson's report, has the effect of rendering of little value the indications of the two latter instruments, which is to be regretted, as it was intended that they should be recorded together with those of the Beckley's anemograph on the summit of the tower, in order to ascertain their comparative values. This object has, of course, been sacrificed. But the anemometric data for the observatory are now taken solely from the anemograph, and this is in no way prejudically affected

The Jubbulpore observatory has been very assiduously superintended by the Superintendent, Dr. Rice, but he has had much trouble with the observers. One of them resigned on the 28th February 1882, and he was succeeded by a clerk of the Bengal Meteorological Office, who had applied for the post, and, after being trained at Alipore, was sent up to Jubbulpore. He is reported to have worked most unsatisfactorily, pleading illness as the cause; but this plea is not confirmed by the Civil Surgeon. At the close of the year arrangements were being made for replacing him.

A Casella's embossing anemograph has been set up at Jubbulpore on the summit of the tower of the civil branch dispensary, an excellent position, in which, if anywhere, in the interior of India, it should work well. It has, however, been necessary to lengthen the driving chains of the instrument, and some delay was incurred in procuring chain suitable for this purpose. The barometer, hitherto kept in the Central Jail, was removed to a lower room in the same building, on the morning of the 8th April 1881. The present position is 10 feet higher than that which it formerly occupied. The thermometer shed, together with the old wind vane and anemometer, are apparently retained in their old position on the *maidan* in front of the jail.

Of the third class stations, Saugor has been very unsatisfactory. The observer has repeatedly sent in imaginary readings of the barometer, which, when laid down on the daily charts, were at once detected as false, by their discrepancy with those of other stations around. After repeated warning and fining, as he was found persistently to recur to this practice, it was resolved to dismiss him, and accordingly he was dismissed, shortly after the close of the year under report. The position of the wind vane and anemometer at this observatory has been greatly improved by the erection of a mast, the top of which is made accessible by a ladder.

With this exception, the work of the third-class stations in the Central Provinces has been generally satisfactory; and the observers at Nagpur, Hoshangabad, Chanda, and Sambalpur have been selected for the special allowances recently sanctioned by Government. The names of all superintendents and observers, who have officiated during the year, are given in the return appended to Dr. Simpson's report (Appendix D II).

OBSERVATORIES IN BERAR.—There are five of these—as in the previous year, one, *viz.*, Makhla—being established in connection with the Forest Department, and working as a fourth-class observatory. It contributes its registers to the Meteorological Office, Calcutta. The remainder are under the direction of the Meteorological Reporter for Western India, in conjunction with the Sanitary Commissioner for Berar. They are—

Third Class.

Akola.
Buldana.
Chikalda.
Amraoti.

Fourth Class.

Makhla.

None of these observatories have been inspected during the year, but, as judged by the registers, they appear to have worked well. The observations of the nocturnal radiation thermometer at Chikalda have alone been rejected as untrustworthy. The observers at Akola and Amraoti have been selected for the special allowances recently sanctioned. The names of all superintendents and observers, at the four third-class observatories, are given in the Appendix to Mr. Chambers's Report (Appendix E II).

OBSERVATORIES IN CENTRAL INDIA AND RAJPUTANA.—The number of these observatories is the same as at the beginning of the year, *viz.*, one of the second and nine of the third class, as follows:—

Second Class.

Jeypore.

Third Class.

Sutna.
Nowgong.
Neemuch.
Indore.
Mount Abu.
Pachbudra.
Ajmere.
Sambhar.
Bickaneer.

The observatory at Jeypore, founded and supported by the Maharajah of that State, has contributed a very valuable register during the past year; the work being carried on on the same system as at Allahabad, and comprising daily observations at six-hourly intervals (4h. and 10h. A.M. and P.M.), hourly readings of all the instruments on four days in each month, synoptic observations daily for the Washington Chief Signal Office; and observations of the temperature of the ground at various depths down to 20 feet. The results of all these are very liberally placed at the disposal of this office, and a daily weather telegram is transmitted to the Meteorological Office as from the observatories established by this Department.

During the past year, the Superintendent, Dr. T. H. Hendley, applied to me for assistance in procuring a Van Rysselberghe's meteorograph for the Jeypore observatory, in order that it might be raised to a first-class observatory. As, at this time, the instrument procured for Lahore was lying unused at Calcutta, and, as already stated, there appeared to be little prospect of its being usefully set up at that station, it was, with the sanction of Government, placed at the disposal of the Maharajah, who accordingly purchased it, and had a building specially constructed for its reception. At the close of the year, it was about to be fixed in position.

A memorandum on the Jeypore observatory, by Dr. T. H. Hendley, is appended to Mr. Hill's report (Appendix B I).

Of the third-class observatories, Sutna, Nowgong, Ajmere, and Sambhar now communicate their registers to Mr. S. A. Hill, the Meteorological Reporter to the Government of the North-Western Provinces and Oudh; Neemuch, Indore, Mount Abu, and Bickaneer, to the Meteorological Reporter for Western India; and Pachbudra sends them direct to the Calcutta Meteorological Office.

Sutna, Jeypore, Ajmere, and Sambhar were all visited by Mr. Hill during the year. Of Sutna, he says, everything was in good order, excepting a Casella's anemograph that had been recently set up. This instrument, he reports, has not given traces of any value. "It would probably work very fairly in England, or at a sea-coast station in India; but for the interior of the country, it has the fatal defect of depending on the movement of the wind to carry forward the recording paper. Consequently, at night, when light winds and calms prevail, the hammer which embosses the direction mark comes down hour after hour on the same spot, and 24 distinct impressions are hardly ever obtained in twenty-four hours." This opinion of the comparative unfitness of the Casella's anemograph for the interior of India, where the wind movement is frequently very low, is perfectly just. But it has been found that at the inland station, Cuttack, very useful registers are obtained from a precisely similar instrument, by the simple expedient of marking in ink the 10 h. and 16 h. impressions of the die. Reading backwards and forwards from these, it but rarely happens that there is any difficulty in measuring off and tabulating the wind movement and direction throughout the day.

On the other third-class stations visited, Mr. Hill offers no special remark. The names of the superintendents and observers at the stations on his list are given in the appendix to his report. The observer of Sutna, Harnath, has had one of the special allowances conferred on him for meritorious work.

Of the four observatories that report to Mr. F. Chambers, none has been inspected during the year. It will be seen in the list of defective observations, given in Mr. Chambers's report (Appendix E), that at Mount Abu, for some days in April, and again from the middle of October to the end of the year, the barometric observations appear to be untrustworthy. Moreover, from the 16th June to the 14th October no observation were recorded, and the same from the 8th February to the 18th March. Thus the observatory of Mount Abu has furnished trustworthy registers for only one or two months of the year. It will be seen that similar vexatious interruptions have occurred at several observatories in Bombay, and I reserve my remarks on this subject until the latter have been also noticed. The registers received from Bickaneer, Neemuch, and Indore seem to have been satisfactory in all respects. Special allowances have been awarded to the observers of Bickaneer and Neemuch.

The registers of Pachbudra have been in some respects very unsatisfactory; the readings of the solar radiation thermometer throughout the year are evidently worthless. Equally so are those of all the minimum thermometers during the later months of 1881 and the earlier months of 1882; and it is obvious that there is much want of intelligence on the part of the observer, combined, apparently, with a considerable amount of negligence of the instructions furnished for his guidance.

OBSERVATORIES IN THE BOMBAY PRESIDENCY.—The number of observatories in Bombay has been the same as during the previous year, *viz.*, fourteen; one of which, Colaba, is independent of the Department; and one, Karwar, is a voluntary observatory, only the instruments being furnished by the Department. They are as follows:—

First Class.

Colaba observatory (Bombay).

Second Class.

Belgaum.
Poona.
Deesa.
Kurrachee.

Third Class.

Jacobabad.
Hyderabad.
Bhuj.
Rajkot.
Surat.
Sholapur.
Ratnagiri.
Karwar.
Malegaon.

Mr. Chambers has not inspected any of the observatories under his administration during the past year. The reason assigned for this is, that the working of the new storm-signal service had kept him in Bombay; and no arrangement had been made for carrying on this work during his absence on inspection duty. This result is, I think, very much to be regretted. The reason offered, although no doubt *bonâ fide*, is one which, judging from the experience of the Bengal office, where, for many years, a storm-warning system has been steadily carried on, should not have been an insuperable obstacle to the performance of this very essential part of the reporter's duties. The difficulty was first reported in January 1882; but as I was absent on leave, the matter was allowed to stand over until my return in March; it was then at once brought before the notice of Government, and the obvious suggestion that, during the reporter's absence, the administration of the storm-warning system should be carried on by the very competent resident meteorologist, the Superintendent of the Colaba observatory, was approved and carried out by the orders of the Government of Bombay.

As will be seen from the tabular statement in para. 13 of Mr. Chambers's report, the registers at several of the observatories have been subject to interruptions, more or less prolonged, owing to the sickness of the observers or their absence on military duty; chiefly to the latter; and, in addition to the instances enumerated by Mr. Chambers, was a very vexatious interruption of the Poona registers and telegraphic reports for several days in July, owing, as was reported at the time, to the observer's indulging in a drinking bout, and thereby incapacitating himself for his duty. As it is only in Bombay and Rajputana—and in these provinces only at stations at which either soldiers or assistants in military hospitals are employed as observers—that these interruptions are at all common, it is evidently desirable that civilians should be substituted for persons subject to military rules; and, accordingly, the Reporter for Western India has lately been requested to make preliminary enquiries, with a view to such a change of system.

In paragraph 20 of his report, Mr. Chambers has given a list of the observatories, which have been struck out of the registers as untrustworthy. Among the Bombay stations, Jacobabad, Kurrachee, Deesa, Rajkot, Poona, Ratnagiri, and Belgaum have furnished uniformly good registers. The defective work at Hyderabad, Surat, Malegaon, and Sholapur is attributed to the observers being new and untrained. At Hyderabad, owing partly to the absence of the observers, partly to their incapacity when present, the registers have been more particularly defective; and this station must rank with Mount Abu as very unsatisfactory.

The names of the superintendents and observers at the several observatories in Bombay, as well as those in Rajputana, Central India, and Berar that are administered by the Meteorological Reporter for Western India, are given in the appendix to Mr. F. Chambers's report (Appendix E II). The special allowances, lately sanctioned, have been awarded to the observers at Belgaum, Bhuj, Surat, and Ratnagiri.

OBSERVATORIES IN MADRAS, MYSORE, AND HYDERABAD.—There has been no change in the number of observatories in these provinces during the last year, except that the Ootacamund observatory ceased to contribute registers in March 1881, thus reducing the total to fifteen after that date. The Wellington observatory is, however, now working satisfactorily, so that the Nilgiris are not left unrepresented. Of the following stations, one, Vizagapatam, is a private observatory, established by Mr. A. V. Nursingrow, to whom the office is indebted for the communication of full registers of four observations daily, and also for daily telegrams of the weather and such other information. The others were all working as third-class stations, up to December 1881, when Trichinopoly and Bellary were at length raised to the status of second-class stations, as originally intended :—

Second Class.

Vizagapatam.
Bellary.
Trichinopoly.

Third Class.

Madras.
Madura.
Coimbatore.
Wellington.
Salem.
Negapatam.
Cochin.
Mangalore.
Bangalore.
Secunderabad.
Masulipatam.
Mercara.

With the exception of Vizagapatam, all the above observatories are now under the immediate administration of the Meteorological Reporter to the Government of Madras. In December 1881, those of Mangalore and Mercara, which had been established by the Meteorological Reporter to the Government of India, and, up to that time, had sent their registers direct to the Central office in Calcutta, were transferred to the Madras office.

In Appendix F, is given the very interesting and comprehensive report of the Meteorological Reporter, Miss Pogson, who was appointed by the Government of Madras to the charge of the Meteorological establishments in the Presidency and took over charge of the Meteorological office on the 25th July 1881. This is the first general report that has ever been received on the working of the Madras Meteorological office, since its establishment; and the detailed description which it gives of the position of the observatories and their history is a very useful introduction to the remarks on their present condition.

Miss Pogson has not personally inspected any of the observatories under her charge during the year; but four of the observatories in the above list, *viz.*, Secunderabad, Bangalore, Negapatam, and Madura, were inspected by Mr. Eliot, when officiating as Meteorological Reporter to the Government of India, in January 1882. On Secunderabad Mr. Eliot's report is very unfavourable. "The instruments were generally very dirty, the wet bulbs were covered with a thickish encrustation, and the remaining thermometers more or less coated with dust. The grass radiation thermometer, although in use, was quite out of order, three separate portions being detached from the main column. The support of the wind vane is several degrees out of the vertical; the anemometer is quite loosely attached to its wooden base; there is no receptacle for the rainfall in the rain-gauge. Altogether the condition of the observatory was most unsatisfactory." Further, "the observer is quite unable to read the anemometer, and the previous wind returns are worthless." "I am quite convinced, in my own mind, that he has not taken the observations accurately, at the hours laid down by the Madras Reporter;" and finally, he sums up the results with the remark, "under these circumstances it appears to me that the observations of this observatory are of little or no value."

That Secunderabad has always been a very unsatisfactory observatory, I had some reason to believe, from the consideration of the telegraphic reports and from such waifs of information as have reached me from time to time. But Mr. Eliot's report shows that it was far worse than I had imagined; and it affords a warning example of the condition into which Meteorological observatories in India are likely to fall, when not under the charge of an officer specially interested in the work, or when not kept up to the mark by frequent inspection. The observer, in charge, at the time of Mr Eliot's visit, has since been removed; and, as far as the daily reports admit of an opinion being formed, the work of the observatory appears to be much improved.

Bangalore, and indeed all the remaining observatories, are more favourably reported on. Of this observatory Mr. Eliot says, "The barometer is well placed and in good order. The shed is in very fair condition and the instruments properly placed and in good order, except the wet bulb, which was covered with a slight encrustation." The wind vane and anemometer were very dirty and required cleaning, but the remaining instruments were in good order; and the observer is reported as doing his work carefully, accurately, and neatly."

The report on the Negapatam observatory is uniformly favourable. "The shed is well placed, open in all directions and in good order. The various instruments are all clean and in perfectly good order. The observer takes the observations accurately and intelligently. The condition of the observatory is very satisfactory and creditable to the observer."

Lastly, on the Madura observatory, Mr. Eliot reports: " The shed and instruments are generally in good condition and properly placed." The site was rather too much shut in by trees and shrubs, and Mr. Eliot recommended their partial clearance; also that the barometer be changed, as the mercury required cleaning. But he concludes—" I am quite satisfied with the condition of the observatory. The observer, I may add, takes the observations accurately, and his records appear to be in good order."

Miss Pogson's report on the working of the majority of the remaining observatories is very favourable. Partial exceptions are, however, furnished by Trichinopoly, Masulipatam, and Salem, where the observers do not give satisfaction in reducing and correcting their readings, and forwarding the complete registers, with due promptitude, to the Madras office. The second-class observatory, Trichinopoly, is in this respect most unsatisfactory.

The report acknowledges, with special thanks, the assistance given by the Medica officers in charge of the several observatories; their names, together with those of the observers at each station, are given in the list appended to the report.

There has been much improvement in the communication of the registers of the Madras stations to my office; and the Meteorological Report for 1880, lately issued, is complete in the registers of the Madras stations, as well as in those of other parts of India.

OBSERVATORIES IN BRITISH BURMAH.—Of the eight observatories in British Burmah, one, Akyab, has always been under the direction of the Meteorological Reporter to the Government of Bengal, and is enumerated with the Bengal stations in his report. Another, Diamond Island, was established for the especial purpose of storm warnings, and sends a daily telegram to the Bengal office, and also to Simla during the season. But the registers, as well as those of the remaining Burmese stations, are dealt with in my own office. The remaining stations are under the immediate direction of the Sanitary Commissioner of British Burmah. The following is a list:—

Second Class.

Rangoon.

Third Class.

Bassein.
Diamond Island.
Akyab.
Thyetmio.
Tounghoo.
Moulmein.
Mergui.

A list of the superintendents and observers, at the six stations under the Sanitary Commissioner, is given in Appendix G; that of the Akyab observer in Mr. Eliot's report (Appendix A).

I have no report from the Sanitary Commissioner on the condition of the Burmese observatories, and none have been inspected by myself or other Meteorological officer during the year. As judged by the registers, they appear to have worked well, with the exception of the Rangoon observatory, the registers of which have been sent in full of errors, due to carelessness in the reductions, and Tounghoo, at which station, up to the end of June, one of the minimum thermometers was evidently out of order—a fact which implies carelessness and inattention to the printed instructions. Special allowances have been awarded to the observers of Moulmein and Bassein.

OBSERVATORIES AT THE BAY ISLANDS.—Of these there are two as in former years, both of the third class; they are—

Third Class.

Port Blair (Andamans). | Nancowry (Nicobars).

The list of superintendents and observers during the year 1881-82 is given in Appendix H. The observer at Port Blair has received a special allowance for long and approved service. The registers received from both observatories have been satisfactory.

EXTRA INDIAN OBSERVATORIES.—The only addition that has been made to the list of extra Indian observatories given in last year's report, has been that established on Amini Divi in the Lakadives, and this was established in September 1880; but I have only lately received any report of the fact, and it was not noticed in last year's report. I have as yet no registers. On the other hand, the very important observatory of Gilgit in the extreme north of Cashmere has, I regret to say, been relinquished, owing to the withdrawal of the British Resident. The total number of observatories was therefore the same, at the end of the year under report, as were noticed in the report for 1880-81. But Zanzibar has been raised to the status of a second-class observatory. The list therefore stands as follows:—

Second Class.

Leh. | Aden. | Zanzibar.

Third Class.

Bushire. | Katmandu.
Quetta. | Amini Divi.
Gilgit.

And one foreign observatory in the peninsula, *viz.*, Goa, the Director of which, Senor Antonio Martius, communicates half-yearly registers to this Department and also a daily weather telegram.

The observatory at Aden was visited by myself on the 14th December last, during the stay of the mail steamer, in which I was proceeding to England. The observatory was in the same position, in which it had been at the time of Mr. Eliot's visit in the previous year, *viz.*, at the house of the First Assistant Political Resident, Captain Hunter. Excepting that the minimum thermometer had a break in the column; that the sun thermometer had been injured in transport, and the nocturnal radiation thermometer had about 3° of the spirit column lodged at the upper end of the tube, the instruments were all in good order. The latter instrument had been thus defective for about two months, and the readings for that period must therefore be rejected. The sun thermometer readings, too, must be open to doubt, as the black coating of the bulb had been partly removed in transit, and one of the brass supports was broken and lying in fragments inside the vacuum tube. Moreover, the vibration of the stand, on which it was supported, was such that, in any case, the readings must be open to some doubt.

The Leh observatory has been very carefully superintended by Mr. Ney Elias, the British Joint Commissioner. In discussing the temperatures recorded in past years, and comparing the maximum self-registered temperatures with the reading of the standard thermometer, the former appeared in many cases so excessive, as to be highly improbable. Accordingly, Mr. Elias carefully examined the action of the instruments and detected a peculiarity in that of the maximum thermometer which fully explained the observed discrepancy, although its cause is still somewhat obscure. The instrument is one of Negretti and Zambra's patents, in which the column breaks at a constriction above the bulb. In the early morning, the instrument was found to agree well with the standard, but about 10 o'clock the column moved forward up the tube, and during the later hours marked a temperature many degrees too high. The cause of this pecu liar action, as I have already remarked, has not been fully explained. But it results that no dependence can be placed on the maximum temperatures recorded at Leh with this instrument.

The work of this observatory, as far as it depends on the observers, has been as satisfactory as in former years, and a special allowance has been conferred on the assistant observer, Bhola, whose excellent work in Yarkand has been prominently noticed in the Indian Meteorological Memoirs; also temporarily on the observer, whose duties at Leh are now nearly at an end.

The observatory at Zanzibar has been admirably conducted by Dr. Robb, who received charge of it from Dr. Peters a few days after the beginning of the year; and who, up to the end of the year, recorded the observations himself. A paid observer was appointed on the 1st January 1882, and the observatory now records synoptic observations, in addition to those of 10h. and 16h.

The observatory at Bushire has no paid observer; but the register is carefully supervised by the Resident, Colonel Ross, the observations being recorded by an employé in the Residency office.

The registers of Quetta have been more satisfactory during the latter part of the year than at the beginning. In July 1881, it was reported by an officer of the Topographical Survey who had occasion to make use of the barometric registers, that the observations were being recorded according to Madras time, which differs from the local time by nearly one hour. This practice, which is in direct violation of the rules laid down and emphasized for the guidance of the observer, was stopped at once, but all past registers are to some extent vitiated by the consequences of the negligent disregard of the rules.

The Katmandu observatory has yielded fairly good work during the past year.

The Amini Divi (Lakadives) observatory began work in September 1880, but no report had been received of this fact until quite recently, and no registers have yet reached me. The observer was trained at Madras and is said to be intelligent and anxious to undertake the duties. As the observer, who is also the hospital assistant, has to go on circuit for several weeks together, there are, uufortunately, frequent interruptions in the registers. Moreover, he was away on privilege leave for 3 months, and as no substitute could be found to carry on the observations, another break has been caused by his absence. When the registers have been received and the results compared, I shall be in a position to say whether it would not be advisable to appoint a special observer on a higher rate of pay, as suggested by Miss Pogson in her report.

The Gilgit observatory was closed on the 8th July, owing to the departure of the Resident and his establishment.

RAINGAUGE STATIONS.—The stations which record rainfall only, communicate their registers to the Meteorological Reporters of Bengal, the North-Western Provinces, and to the Government Astronomer, who was formerly Reporter for Madras; and the returns are published by them, weekly or monthly, in the local Gazettes. In other provinces, they are either under the Revenue Boards or the Sanitary Commissioners; and the returns are in most cases published in a similar manner. From the whole a selection has been made, chiefly those of the sudder stations, or the seats of political agencies; and these, with the addition of 23 contributed by the Residents of Hyderabad and Mysore, together with a few from private observers, and amounting to 307 in all (exclusive of the regular observatories), are given in the Annual Report, in conjunction with those furnished by the observatories.

During the past year, some additions have been made to the list of the rain-gauge stations, some of the more important of which have been enumerated at page 3.

Mr. Hill has also established rain-gauges at three of the pilgrim dispensaries in Garhwal, all near the snows, and in a region from which the returns of the atmospheric precipitation, hitherto, have been very scanty. And Dr. Hendley has lately undertaken to establish some additional registers in the dry region of Western Rajputana. The rain-gauges, established by the Commissioner of Cuttack in the Tributary Mehals of Cuttack, have contributed registers during the past year, for this hitherto unrepresented hill tract.

Steps have been taken, by the Government of the North-Western Provinces, to supply trustworthy gauges to the sudder stations in each district; a step the necessity for which was shewn in Mr. Hill's report of last year.

In Bombay, Symon's gauges were supplied to all stations in 1877.

Observations at Sea.—Some steps were taken to extend the system of marine meteorology during the past year. Mr. Eliot has collected the observations taken on board the light-vessels stationed off the mouth of the river, and has received meteorological extracts from the logs of several vessels entering the port, which he obtained through the kind assistance of Mr. S. R. Elson, Master Pilot, and also of the captains of several vessels; many of whom, he reports, appear to be ready and willing to give any assistance in their power to the Meteorological Department.

Under the sanction of the Government of India, a special department has now been organised in this office, under the charge of Mr. Eliot, which will undertake to collect in a more systematic manner, such information on the subject of the weather at sea, as the Masters of ships visiting the ports may be able and willing to furnish from their log books. And special forms of weather logs have been prepared for the use of such as may be willing to keep a regular register for the office. These arrangements did not, however, come into operation before the close of the year under report, and they will be noticed at length in the Administration Report for the year now current.

Mr. F. Chambers has collected a number of registers relating to a severe cyclone which crossed the Arabian Sea between May 27th and June 3rd, 1881, but which was not felt at Bombay.

INSTRUMENTS.

The following is a return of the Instruments in store at the beginning of the year, and of those received and issued by the Calcutta Meteorological office, which is the general depôt for all India; this list includes the stock, receipts, and issues of the Alipore observatory.

Return of the Stock and Issue of Instruments for the year 1881-82.

INSTRUMENTS.	In store on 1st April 1881.	Received 1881-82.	Issued 1881-82.	REMARKS.
Van Rysselberghe's Meteorographs	2	...	1	Sold to the Maharajah of Jeypore.
Barometers, Observatory, Fortin's Principle	4	11	3	
Ditto, ditto, Kew ditto	2	5	4	
Ditto, Mountain portable tripod (Adie)	19	10	7	
Ditto, Marine K. P.	14	12	...	
Ditto, ditto Fitzroy	7	...	7	Returned to Mathematical Instrument Department.
Ditto, Adie's large standard	6	...	6	
Ditto, Newman's ditto	2	...	...	
Ditto, ditto small ditto	5	...	1	
Ditto, Negretti and Zambra's (various)	16	1	3	
Aneroids	19	...	...	
Thermometers, standard, with attached scales	20	1	...	
Ditto, ditto, without attached scales	1	...	...	
Ditto for hygrometers (Kew pattern)	112	16	35	
Ditto, maximum for shade	142	11	20	
Ditto, minimum ditto	82	16	33	
Ditto, ditto radiation	9	52	49	
Ditto, solar in vacuo	35	58	46	
Pouillet's pyrheliometer	1	...	...	
Stewart's actinometers	2	...	1	
Hodgkinson's ditto	2	...	...	
Herschell's ditto	1	...	...	
Regnault's hygrometers	4	...	1	
Daniell's ditto	10	...	...	
Halleur's ditto	5	...	...	
Boiling-point thermometers	6	...	...	
Pocket spectrescopes (Browning's)	2	...	...	
Wind vanes	21	1	2	
Anemometers	22	12	23	
Rain-gauges (Symon's and Glaisher's)	6	21	6	
Spare measure glasses for ditto	7	...	6	
Hutchins' rain-gauge	...	1	1	
Reading lenses	6	...	1	
Sun thermometer stands	35	...	11	
Radiation pads	13	...	10	

Return of the Stock and Issue of Instruments for the year 1881-82.—concluded.

INSTRUMENTS.	In store on 1st April 1881.	Received 1881-82.	Issued 1881-82.	REMARKS.
Thermometer cages	5	1	4	
Prismatic compass	1	...	...	
Magnetic ditto (common)	...	1	1	
Sand glasses (3 minutes)	4	25	...	
Sundials (universal)	...	3	3	
Photographic dishes	...	6	6	Issued to Alipore observatory.
Glass tubing	...	10 lbs.	10 lbs.	
Aspirator	...	1	1	
Chain for Casella's anemograph	...	50 ft.	35 ft.	
Apparatus for verifying thermometers	...	1	1	Ditto ditto.
Glass disc for nephescope	...	1	1	
Watches	...	2	2	
Arithmometer	...	1	1	Issued to Office.
Planimeter	...	1	1	
Spirit levels	...	2	2	
Sunshine recorders	...	3	2	1 to Alipore observatory.
Bull's-eye lanterns	1	2	2	
Salinometers	41	...	1	
Common thermometers, brass scales	33	...	...	
Clocks	...	21	18	

The following table, in which is incorporated the lists received from the Local Reporters, shews the instruments that have been issued to each observatory during the year :—

Return of the Instruments issued to Meteorological Observatories in 1881-82.

Provinces.	STATIONS.	Barometers.	HYGROMETERS.		Dry maximum.	MINIMUM THERMOMETERS.		RADIATION THERMOMETERS.		Anemometers.	Wind vanes.	Rain-gauges.	Measure glasses for rain-gauge.	Standard thermometers.	Lenses.	Lanterns.	Clocks.	Sun thermometer stands.	Woollen pad for grass radiation thermometer.	Thermometer cages.	REMARKS.
			Dry.	Wet.		Dry.	Wet.	Solar.	Grass.												
PUNJAB.	Mooltan	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	1	...	...	...	
	Dehra Ismail Khan	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1	...	...	...	
	Pesháwar	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Murree	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1	...	...	...	
	Rawalpindi	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	1	...	...	...	
	Sialkot	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Lahore	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	2*	...	...	...	* Watches.
	Ludhiana	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	
	Simla	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	
	Sirsa	...	...	...	...	...	...	...	1	1	...	1	...	...	...	...	1	...	...	...	

Return of the Instruments issued to Meteorological Observatories in 1881-82.—continued.

Provinces.	Stations.	Barometers.	Hygrometers.		Dry maximum.	Minimum thermometers.		Radiation thermometers.		Anemometers.	Wind vanes.	Rain-gauges.	Measure glasses for rain-gauges.	Standard thermometers.	Lenses.	Lanterns.	Clocks.	Sun thermometer stands.	Woollen pad for grass radiation thermometers.	Thermometer cages.	Remarks.
			Dry.	Wet.		Dry.	Wet.	Solar.	Grass.												
North-Western Provinces.	Chakrata	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	1	...	...	...	
	Bareilly	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	
	Agra	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	
	Gorakhpur	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	
	Jhansi	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	
	Allahabad	...	1	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	
	Ghazipur	...	...	...	...	1	...	...	1	1	...	...	...	...	...	...	...	...	...	...	
	Benares	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	
	Pauri	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Pithoragarh	...	...	...	...	1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	* Broken in transit.
Bengal and Assam.	Sibsagar	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1	...	...	...	
	Dhubri	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1	...	
	Silchar	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	1	...	
	Darjeeling	2	1	1	1	1	1	2	1	...	...	1	1	...	...	...	...	1	...	1	Original furniture.
	Purneah	...	...	...	1	1	...	1	1	...	...	...	...	...	...	...	...	...	...	...	
	Patna	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Hazaribagh	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	
	Berhampore	...	...	...	...	...	1	1	1	...	...	...	...	...	1	...	...	...	1	...	
	Burdwan	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	
	Jessore	...	...	...	...	...	...	1	...	1	...	1	...	...	...	...	...	...	1	...	
	Chittagong	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	2	...	
	Saugor Island	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1	...	
	Cuttack	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	False Point	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	
Central Provinces.	Raipur	2	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	
	Nagpur	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	
	Seoni	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	
	Pachmarhi	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	
	Chanda	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	
Berars.	Chikalda	1	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	
	Akola	...	...	...	...	...	...	...	...	...	...	1	2	...	...	...	...	...	...	...	
	Amraoti	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	
Central India and Rajputana.	Neemuch	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	
	Nowgong	...	...	...	...	...	...	1†	...	...	...	...	...	...	...	...	...	...	...	...	† Broken in transit.
	Indore	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	
	Bickaneer	1	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	
	Ajmere	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	1	...	...	...	
	Mount Abu	1	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	

Return of the Instruments issued to Meteorological Observatories in 1881-82.—concluded.

Provinces.	Stations.	Barometers.	Hygrometers.		Dry maximum.	Minimum thermometers.		Radiation thermometers.		Anemometers.	Wind vanes.	Rain-gauges.	Measure glasses for rain-gauges.	Standard thermometers.	Lenses.	Lanterns.	Clocks.	Sun thermometer stands.	Woollen pad for grass radiation thermometer.	Thermometer cages.	Remarks.
			Dry.	Wet.		Dry.	Wet.	Solar.	Grass.												
Bombay.	Hyderabad	1	...	...	...	...	...	...	1	...	...	...	1	...	...	...	...	...	...	...	
	Kurrachee	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	
	Bhuj	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	
	Rajkot	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Deesa	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	
	Surat	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	
	Malegaon	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	
	Poona	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	
	Sholapur	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	
	Belgaum	...	...	...	...	...	...	...	1	...	...	...	1	...	...	...	...	...	...	...	
	Karwar	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	
Madras.	Gopalpore	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	
	Bangalore	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	
	Bellary	1	...	...	...	1	1	...	...	1	...	...	...	...	...	...	1	...	...	...	
	Cochin	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	1	...	...	...	
	Coimbatore	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	
	Madura	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1	...	...	...	
	Mangalore	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	
	Negapatam	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	
	Salem	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	
	Secunderabad	1	...	1	...	...	...	...	1	1	...	...	...	...	...	...	1	...	...	...	
	Trichinopoly	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	
	Wellington	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	
British Burma.	Akyab	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	1	...	
	Thyetmyo	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Tounghoo	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Bassein	1	...	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	
	Rangoon	...	...	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	1	...	
	Moulmein	...	1	1	...	...	...	...	1	...	...	...	1	...	...	...	...	...	...	...	
	Mergui	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	
Extra Indian.	Amini Divi	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	
	Aden	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	
	Leh	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	
	Quetta	1	1	1	1	1	1	1	1	1	...	...	...	...	...	...	...	...	...	...	
	Seychelles	1	1	1	1	1	1	...	...	1	1	1	1	...	...	...	...	...	...	1	Original furniture.
	Minor stations not under the Meteorological Department.	1	...	...	1	...	...	...	...	...	...	2	5	...	...	...	...	...	...	...	

METEOROLOGICAL OFFICERS AND OFFICE WORK.

The general control of the meteorological observatories and offices in the different provinces, with the local exceptions noticed in the foregoing sections, has been in the hands of the following officers during the past year:—

Province.	Superintending Officer.	Names.
Bengal and Assam	Meteorological Reporter, Government of Bengal	John Eliot, M.A. Alexander Pedler.
North-Western Provinces and Oudh	Meteorological Reporter, North-Western Provinces and Oudh	S. A. Hill, B.S.C. W. N. Boutflower.
Punjab	Meteorological Reporter, Punjab	Surgeon E. Lawrie, M.D.
Central Provinces	Sanitary Commissioner	Deputy Surgeon General, B. Simpson, M.D.
	Meteorological Reporter, Government of India	H. F. Blanford, F.R.S. John Eliot, M.A.
Berar	Sanitary Commissioner	Dr. Little.
	Meteorological Reporter, Western India	F. Chambers. Surgeon W. Nolan, M.D.
Central India and Rajputana	Meteorological Reporter, North-Western Provinces and Oudh	S. A. Hill, B.S.C. W. N. Boutflower.
	Meteorological Reporter for Western India	F. Chambers. Surgeon W. Nolan, M.D.
Bombay	Ditto ditto ditto	F. Chambers. Surgeon W. Nolan, M.D.
Madras	Meteorological Superintendent, Madras	N. R. Pogson, F.R.S. Miss Isis Pogson.
Burma	Meteorological Reporter, Government of Bengal	John Eliot, M.A. Alexander Pedler.
	Sanitary Commissioner	W. Pearl, M.D.
	Meteorological Reporter, Government of India	H. F. Blanford. John Eliot, M.A.
Bay Islands	Senior Medical Officer, Port Blair	Surgeon W. Beatson. ,, J. Reid, M.B.
	Meteorological Reporter, Government of India	H. F. Blanford. John Eliot, M.A.
Extra Indian Observatories	Meteorological Reporter, Punjab	Surgeon E. Lawrie, M.D.
	Meteorological Reporter, Government of India	H. F. Blanford. John Eliot, M.A.
	Meteorological Reporter, Western India	F. Chambers. Surgeon W. Nolan, M.D.

From the 6th December 1881 to the 5th March 1882, Mr. J. Eliot officiated as Meteorological Reporter to the Government of India, during my absence on privilege leave, and Mr. A. Pedler officiated during the same period as Meteorological Reporter to the Government of Bengal.

Mr. Hill was absent on leave from the 27th April to the 25th June 1881, during which interval Mr. Boutflower officiated as Meteorological Reporter to the Government of the North-Western Provinces and Oudh.

And in Bombay, Mr. F. Chambers was absent, on privilege leave, from the 3rd October to the 27th December 1881, during which time the duties of his office were carried on by Surgeon-Major W. Nolan, M.D., who was appointed to officiate as Meteorological Reporter for Western India, his services having been placed at the disposal of the Government of India.

In Madras, Miss E. Isis Pogson was appointed Meteorological Superintendent to the Government of Madras, in lieu of the Meteorological Reporter, Mr. N. R. Pogson, who had expressed a desire to be relieved of the appointment. Miss Pogson entered on the duties of the office in July 1881. This appointment is the only permanent change that has been made in the *personnel* of the staff. I am glad to report that I have no longer to complain of the preparation of the Annual Report being seriously retarded by any delay in the transmission of the registers of the Madras stations, and the registers are carefully checked and reduced in the Superintendent's office.

At the same time, greater despatch in the communication of the registers is very desirable, in the case, not only of Madras, but also of the North-Western Provinces, the Punjab, and some Burma stations. In the case of the three first-named provinces, the delays are undoubtedly due to the fact that the local office establishments are insufficient to deal promptly with the registers, in the face of the increasing work thrown upon them, not only by the increase of the number of observatories with which the Madras and North-Western Province officers have to deal, but also by the increased demand for special returns of various kinds which are required by the Local Governments and their subordinate departments. In the case of the Burmese stations, more particularly Rangoon, the fault lies with the observers, and can be dealt with departmentally; but the Reporters for the North-Western Provinces, the Punjab and Madras certainly require some additional assistance.

The following table shews the number of stations the registers of which were sent to each of the Reporters respectively during the year under report:—

Provinces.	Meteorological Reporters.						Total.
	India.	Bengal.	North-Western Provinces and Oudh.	Punjab.	Western India.	Madras.	
Bengal and Assam	3	19	...	...	...	...	22
North-Western Provinces and Oudh	2	...	15	...	...	...	17
Punjab	...	...	...	11	...	...	11
Rajputana and Central India	1	...	4	...	4	...	9
Central Provinces	11	...	...	...	...	...	11
Berar	1	...	...	...	4	...	5
Bombay	...	...	...	...	13	...	13
Madras, Mysore and Coorg	...	...	...	...	...	14	14
Burma	7	1	...	...	...	...	8
Bay Islands	2	...	...	...	...	...	2
Extra Indian	5	...	...	1	1	1	8
Total	32	20	19	12	22	15	120

This list does not include the registers of the Colaba observatory, of Goa, Jeypore, and Vizagapatam, which are furnished to the Meteorological office with all the necessary reductions.

The number of stations dealt with in the office for India is reduced by four, as compared with that given in last year's report. This is accounted for by the suppression of the two observatories of Thull and Ootacamund, and the transfer to Madras office of those at Mercara and Mangalore. The addition of these two observatories to the Madras Reporter's list, and the establishment of the Amini Divi observatory raises the number under that office from 12 to 15, and the number under the Reporter for the N.-W. Provinces and Oudh is raised from 16 to 19 by the addition of the three new observatories at Pauri, Pithoragarh, and Ghazipur. In Bengal and the N.-W. Provinces, the Meteorological Reporters superintend, also, the numerous rainfall registers of the district and sub-divisional stations of their respective provinces, and prepare weekly or monthly returns of the rainfall; and in Bengal and Bombay, the Reporters have also charge of a system of daily reports received by telegraph; in the case of the former from 15, in that of the latter from 10 stations. The Meteorological Reporter for Bengal also administers a system of meteorological registration at sea, which received a considerable development about the close of the year.

Office Establishments.—The following is a return of the number of employés in the offices of the several Meteorological Reporters, as far as information has been received, up to the end of the year under report:—

	India.	Bengal.	North-Western Provinces.	Punjab.	Western India.	Madras.	Total.
Head clerks	1	1	1	1	1	1	6
Computors	2	...	4	1	6	1	35
Clerks and Copyists	3	2					
Tabulators	13	3					
Draughtsmen	2	...	...	...	...	...	2
Artisans	...	3	...	...	...	...	3
Peons and menials	6	4	1	1	1	1	14

The offices for India and Bengal were during a part of the year, as in former years, under the management of the same Head Clerk, Babu Fanindra Mohun Basu, of whose excellent service I have much satisfaction in recording my entire approval. His health unfortunately failed him both in the cold weather of 1880-81, and again during the rainy season, compelling him to be temporarily absent from office; and in the absence of any junior clerk competent to discharge his duties, an undue amount of vexatious detail was thrown upon Mr. Eliot, who was then in charge of the Calcutta portion of my establishment in addition to his own. As, moreover, the work of both offices had increased so much since 1875 that, even when the Head Clerk was in good health, the duties had become almost too onerous for one controlling clerk, the two offices were separated in August last, and another Head Clerk was appointed to the management of the Bengal Office, who should, moreover, take temporary charge of that of India, in the event of Babu

Fanindra Mohun Basu being again incapacitated by sickness. On the 24th August, Babu Fanindra Mohun Basu made over charge of the office of the Meteorological Reporter for Bengal, an office which he had held for nearly twelve years, and on this occasion Mr. Eliot remarks: "I cannot allow the opportunity . . . to pass without expressing my sense of the zeal and ability with which he has discharged his duties in that capacity for so many years. It is very largely owing to his power of work and control over the clerks in the office that it has adapted itself readily to the expansive changes which have been made in it since its establishment, and that it has always been equal to the various duties imposed on it by Government, and that there has never been any accumulation of arrears in the work of the office." I am glad to be able to add that during the past cold season his health has been so much better than for two or three years previously, that he has been able to attend office without interruption.

The position of that portion of my establishment which has to deal with the reduction of the registers and the tabulation of the data, for publication in periodical reports and other forms, or for communication to other departments requiring information, has been much improved during the past year, by the formation of a superior grade on higher salaries. From the 24th September and up to the close of the year the tabulators were classified in three grades on salaries as follows:—

3	of the	first	class	at	Rs. 40	rising	to	Rs. 55
6	,,	second	,,	,,	,, 30	,,	,,	,, 40
3	,,	third	,,	,,	,, 20	,,	,,	,, 30

Some additions to the office for dealing with marine observations have been sanctioned, but these did not take effect until the beginning of the current year.

An additional clerk has been sanctioned for the office of the Madras Superintendent, but Miss Pogson's office, as well as those of the Meteorological Reporters for the North-Western Provinces and the Punjab require some additional assistance, and application for this will be submitted as soon as I receive the necessary details. The Meteorological Reporter for Western India also remarks on the insufficiency of his office establishment; but I reserve my opinion on this subject until I shall have visited Bombay and enquired into the subject on the spot.

WEATHER BULLETINS AND STORM SIGNAL SERVICE.

The publication of the daily weather bulletins, by the office of the Meteorological Reporter to the Government of India, has been carried on during the past year, in the manner described in the report for 1880-81. They were issued at Simla from the 16th May to the 15th October, the Simla issue being amplified by telegraphic reports from 34 additional stations, of which 24 reported rainfall only; and a verbal notice descriptive of the principal features of the weather of the day accompanied the tabulated contents of the telegrams. A telegraphic abstract of this notice was sent daily to the Meteorological Reporter for Bengal, and was offered also to the Meteorological Reporter for Western India, but was declined by that officer.

Since the beginning of the present official year, the system of the daily weather reports have been greatly amplified; and, during the present season, the telegraphic summary is forwarded to all the Local Governments and Administrations.

A new edition of the Indian Weather Telegraphic Code has been prepared by Mr. J. Eliot, in order to take advantage of the increase in the number of words allowed to the single message, under the Telegraph Rules which came into operation last January. Mr. Eliot has, at the same time, improved the Code, by making provision for the case in which any class of observations cannot be recorded, and has introduced additional items of information, *viz.*, the maximum and minimum temperature, the actual velocity of the wind at the hour of observation, and a more copious weather vocabulary for the same hour. The first and fourth of these additions were suggested by Dr. Murray Thomson and Mr. Chambers as desiderata. Some other improvements were also made on the suggestion of Mr. Pogson, to meet a difficulty that had been felt at Madras. The new edition of the Code was sent to press in the beginning of April. It has now been circulated, and came into operation on the 1st August 1882.

The Bengal system of weather report was greatly improved at the beginning of the official year 1880-81, when the number of reporting stations was increased to 15, and the tabulated data, accompanied by a descriptive notice, and illustrated with a chart of the Bay, was lithographed daily in the office and distributed to Government offices and private subscribers. At the beginning of the year under report, there were 18 of the former and 27 of the latter. At its close, the former had been increased to 23, the latter remaining the same; so that the daily circulation amounts to 50 copies. This work is very exacting, as, during seven months, Mr. Eliot is alone at the Meteorological office, and the work being personal and such as cannot be committed to the establishment, in the event of Mr. Eliot's absence, even for a day (Sundays and holidays included), he must find some other officer to take it over. This he has hitherto been able to do by the kind assistance of Mr. Pedler, and there has been no interruption of the issue. The information given in these daily issues is much appreciated in Calcutta, as is evidenced by the steadiness of the subscription list and the increased demand by Government officials.

The storm signals have, happily, not been much in use during the past year. No violent storm occurred in the Bay, and although, during the rainy season, a succession of small cyclonic vortices were formed in the head of the Bay, and were successively propagated across the Orissa coast towards the Central Provinces, Mr. Eliot reports that only one of these seemed to be of sufficient magnitude and importance to justify the hoisting of the bad weather signal. This was at noon on the 15th July, and the signals remained exhibited for 48 hours. At the close of the monsoon, a small cyclone was formed off the east coast of Ceylon, which reached the coast of Madras and did much damage to the breakwater of the harbour.

Mr. Eliot has devised a new and more elaborate system of storm signals, which, at the close of the year, was under the consideration of the Bengal Government, and has since been approved and sanctioned. The increased knowledge of storms which has been gained by the experience of the storm-warning service during the last 17 years, has enabled Mr. Eliot to distinguish the prognosties of major and minor storms; and although these storms approach from the open sea, from which, at present, no telegraphic reports are forthcoming, he is of opinion that it may be practicable, in many cases, to indicate approximately their probable course, whether they are making for land to east or west of the Hooghly. Information on this point will be of the highest importance to the shipping in the river, as it will enable shipmasters to foresee the quarter from which violent winds may be expected. This information the new code of storm signals is intended to impart, and provision has also been made for doubtful cases, so that when the course is doubtful there may be no risk of misleading by false information.

I have stated above that, at present, no information is obtainable for estimating the probable course of cyclones from any point beyond the boundaries of the land. But a proposal is now before Government, which, if sanctioned and carried into execution, will add very greatly to the precision and certainty of the information obtainable on this head. It is proposed to put the light-ship at the Eastern Channel in telegraphic communication with the land by means of a cable. This will provide a warning station, 60 miles at sea, (from the shore of the Sunderbans), and not only will storm phenomenon be intercepted and reported many hours earlier, but the station will have all the advantages of an open sea observatory, free from the masking and mitigating influences of the land. I anticipate the most important results to the efficiency of the storm-signal service, if this proposal is carried into effect.

Of the working of the storm-signal service in Bombay, Mr. Chambers has given a very full account in his report (Appendix E).

ANNUAL REPORTS.—The report on the Meteorology of the year 1880 was completed (with the exception of one or two pages of summary), and in the printer's hands, by the end of November 1881. And the report was submitted to Government in its complete form on the 25th June 1882.

It gives tables of temperature for 126 stations, and rainfall returns for 399 stations, being an increase of 3 of the former and 34 of the latter on the number summarized in the corresponding tables of the Report for 1879. The returns of pressure, wind direction, and the other meteorological elements are nearly as numerous as those of temperature; and the tables include, for the first time, registers of the ground temperature. The elements tabulated in the appendices are as follow. I give for comparison the number of registers summarized in the corresponding tables of the reports of the four previous years :

	NUMBER OF STATIONS.				
	1876.	1877.	1878.	1879.	1880.
Equilibrium temperatures of solar radiation	80	95	99	106	109
Temperature of nocturnal radiation	65	95	97	100	108
Temperature of the ground	...	...	...	...	2
Mean and extreme air temperatures	95	108	116	123	126
Sea-level equivalents of mean do.	77	94	100	101	105
Means and extremes of atmospheric pressure	92	106	113	119	122
Sea-level equivalents of mean atmospheric pressure	76	93	96	98	105
Direction and movement of winds	91	109	113	118	124
Temperature of evaporation	86	99	106	111	115
Tension of atmospheric vapour	95	106	113	120	123
Mean relative humidity	95	106	114	120	123
Mean proportion of clouded sky	91	104	110	118	122
Inches of rainfall in each month	274	311	353	365	399
Number of days on which rainfall was measured	217	239	276	365	379

The descriptive letterpress discusses the meteorology of the year in detail. It includes 21 numbered tables, giving the average values of all the more important elements, for all stations that have furnished registers for three years and upwards; and the report is illustrated with ten plates, one of which is a chart shewing the positions of all observatories and rain-gauge stations; three represent the distribution of pressure, temperature, and winds in each month of the year; and the remainder illustrate particular phases of weather, *viz.*, the conditions of the cold weather rainfall, and the cyclones that characterize the rainy season. One of these latter illustrates the daily progress of the storm, that culminated in the disaster of the Naini Tal landslip.

The original observations at six stations in India, *viz.*, Calcutta, Lucknow, Lahore, Nagpur, Bombay, and Madras, were issued in monthly parts as a distinct publication, and form a small quarto volume, prefaced by a detailed description of the stations and the instruments employed. The final sheets of the registers for 1880 were issued in December 1881.

Mr. Hill has also published, independently, a summary of the observations of the observatories which he superintends; and Mr. Chambers also prepared and printed a sketch of the local meteorology of Western India, in pamphlet form.

Miscellaneous publications.—Two parts of the Indian Meteorological Memoirs (Parts V and VI) were issued during the year, completing volume I of this publication, which has also been issued as a complete bound volume.

The final parts, contained two papers by Mr. S. A. Hill and one short paper by myself, together with a full and detailed index of the contents of the volume, a page of corrigenda, &c. The volume contains twelve original memoirs, occupying 426 quarto pages, and illustrated by thirty-three plates. Of other casual writings, Mr. Hill has contributed two papers to the Royal Society, discussing the question of the particular constituent of the atmosphere which has the greatest absorbing power for radi~~e~~nt heat; a/ and Mr. Chambers has drawn up a list of the storms recorded on the coasts of the Bombay Presidency, which will be published in volume II of the Indian Moteorological Memoirs. This was not received until more than two months after the close of the last official year.

Mr. J. Eliot has completed one memoir, also for publication in the first part of volume II of the Indian Meteorological Memoirs, and has the materials for two other investigations in hand. This first is a very full and detailed report on the south-west monsoon storm, which occurred at the head of the bay and passed across Central Bengal in September, 1878. The materials of the discussion were collected by Mr. Pedler, and as it appeared to be a typical example of this class of storms, Mr. Eliot has investigated very fully the meteorological conditions under which it originated and was developed. The other subjects on which Mr. Eliot has been engaged are: first, an enquiry into the probable relations between the abnormal variations of pressure over India during the pre-monsoon period, March to May inclusive, and the abormal distribution of rainfall during the succeeding months of the south-west monsoon; and, second, an investigation of the existence and character of the regular oscillatory changes of atmospheric pressure in India, other than annual and diurnal oscillations. Some further remarks on both these objects of enquiry will be found in Mr. Eliot's report (Appendix A).

The discussion of the old registers of Indian rainfall and the preparation of a general rainfall chart of India have occupied the little spare time that I have been able to devote to special work of this kind. The former, when completed, will be published, together with the data in full, in the Meteorological Memoirs. For the latter, a special contoured map of India is now being prepared in the office of the Surveyor General, on which the rainfall data will be laid down. As contributions to this work, Mr. S. A. Hill has already prepared and published a rainfall chart of the North-Western Provinces and Oudh ; and I have reduced and laid down the data for the Madras Presidency and Mysore, while Mr. Hill has done the same for that of Bombay. It is proposed to submit these portions for the opinions of the local officers, before putting them together on the general chart, and it is hoped that the final work will be of such a character that it may be referred to, with confidence, by those engaged in agriculture, irrigation schemes and other undertakings, in which a knowledge of the local rainfall is an important datum.

A comparative return of the rainfall of India in 1881 was prepared, and, together with illustrative charts, submitted to Government for communication to the Secretary of State on the 11th April 1882.

Appendix I gives a list of the Government officials, offices, libraries, institutions, &c. to which the publications of the office are presented, including those which furnish their own publications in exchange.

LIBRARY.

The Library is contained in five large double book-cases and is in excellent condition. The list of the additions made during the past year is given in Appendix J.

HENRY F. BLANFORD,
Meteorological Reporter to the Government of India.

SIMLA :
The 26th August 1882.

APPENDIX A·

Extract from the Administration Report of the Meteorological Reporter to the Government of Bengal, for the year ending 1881-82.

DURING the year 1881-82 meteorological observations were taken regularly at one first-class observatory, seven second-class observatories, and twelve third-class observatories in Bengal and Assam.

From the 1st of April 1881 to the 6th of December 1881, the Department was under my superintendence. From that date up to the 5th of March 1882, during which I was acting as Meteorological Reporter to the Government of India, on account of the absence of Mr. H. F. Blanford on three months' privilege leave, Mr. Alexander Pedler, Professor of Chemistry, Presidency College, officiated as Meteorological Reporter to the Government of Bengal. For the remainder of the official year, the Department was under my superintendence. These changes, to a certain exent, interfered with the inspection of the Bengal observatories. As Meteorological Reporter to the Government of India, I was absent during the whole of the cold weather college vacation, inspecting the observatories in the Punjab, and certain observatories in the Madras Presidency. Mr. Pedler was unable to leave Calcutta during this period, as the preparation of the India and Bengal Telegraphic Weather Reports necessitates the presence of either the India or Bengal Reporter in Calcutta. Mr. Pedler, however, took the opportunity of several college holidays in February, to inspect those observatories which appeared more imperatively to require it.

Second-class Observatories.—These are seven in number, as in the previous year. Five are in Bengal, and the remaining two in Assam. The names of the Superintendents and Observers at these observatories are given in the following table:—

Second-class Stations.

Stations.	Superintendents.	Superintendents' allowance.	Observers.	Observers' allowance.	Assistant Observers.	Assistant Observers' allowance.
		Rs.		Rs.		Rs.
Sibsagar .	Dr. R. M. Meiklejohn .	30	Babu Dundadhar Dutt Barua.* .	30	Babu Brikodar Dutt[1]. Babu Ratneswar Gogoi[2].	10
Dhubri .	,, J. McNaught[3] . . ,, J. Slane[4] . . ,, J. Mullane[5] . .	30	Munshi Maniruddin Ahmed*[6] Munshi Kadimuddin[7].	30	Munshi Kadimuddin. Mahamud Sukhua[8]	10
Bankipore .	,, R. Bird[9] . . Babu Kamkali Goopto[10] . Dr. J. C. Shaw[11] . . ,, B. Simpson[12] . . Babu Ramkali Goopto[13] . Dr. B. Simpson[14]. .	30	Munshi Mohabut Lal.	30	Modden Mohan Lall.	10

---

[1] To 23rd September 1881.
[2] Since 11th October 1881.
[3] From 1st to 9th April 1881.
[4] ,, 10th to 12th April 1881.
[5] Since 13th April 1881.
[6] Privilege leave from 25th September to 23rd December 1881.
[7] From 25th September to 23rd December 1881.
[8] From 25th September to 23rd December 1881.
[9] 1st to 30th April 1881.
[10] 1st to 19th May 1881.
[11] 20th May to 17th December 1881.
[12] 18th December 1881 to 28th January 1882.
[13] 29th January to 22nd March 1882.
[14] Since 23rd March 1882.

* These officers are to receive the special allowance of Rs. 5 per month each from the 1st April 1882.

Second-class Stations—continued.

Stations.	Superintendents.	Superintendents' allowance.	Observers.	Observers' allowance.	Assistant Observers.	Assistant Observers' allowance.
		Rs.		Rs.		Rs.
Hazaribagh	r. R. Cobb[15] ,, J. Lewtas[16] ,, R. Cobb[17]	30	Raheemolla[18] Mahomed Ameer[19]	30	Mahomed Ameer[20] Nathoo Lal (21)	10
Saugor Island	......	...	Mr. R. H. Peters[22] ,, R. A. Pope[23] ,, R. H. Peters[24] ,, E. R. Swatman[25] ,, R. H. Peters[26] ,, J. M. Brachio[27] ,, E. R. Swatman[28]	45		
Cuttack	......	...	J. C. Smith	32	Mr. H. W. Alley[29] ,, G. S. Adshead[30] ,, S. Adams[31]	13
Chittagong	......	...	E. Pereira	32	,, J. Dias	13

---

[15] 1st April to 5th November 1881.
[16] 6th November 1881 to 8th February 1882.
[17] 9th February to 31st March 1882.
[18] 1st April to 12th June 1881.
[19] Since 13th June 1881.
[20] 1st April to 12th June 1881.
[21] Since 13th June 1881.
[22] 1st to 12th April 1881.
[23] 13th April to 26th May 1881.
[24] 27th May to 17th December 1881.
[25] 18th December 1881 to 4th January 1882.
[26] 5th January to 9th March 1882.
[27] 10th March to 20th March 1882.
[28] From 21st March to 31st March 1882.
[29] 1st April to 10th July 1881, 1st to 11th September and 12th Octoher 1881 to 31st March 1882.
[30] 13th to 25th August 1881.
[31] 11th July to 12th August 1881, 26th to 31st August 1881, and 12th September to 11th October 1881.

Five of these observatories are provided with self-registering anemographs. The following table gives the periods during which the instruments have been in working order at each station :—

Stations.	Date of commencement of work.	Periods during which instrument was out of order in 1881-82.
Dhubri	18th March 1882.	
Hazaribagh	15th April 1880.	
Chittagong	20th June 1879	Since 6th February 1882, for repairs to the Telegraph building.
Saugor Island	9th February 1880	9th January to 22nd February 1882.
Cuttack	11th April 1879.	

The only observatories of this class which were inspected either by Mr. Pedler or myself are Dhubri and Patna. The transfer of the Goalpara Observatory to Dhubri, referred to in my last report, was effected during the year. The change was made on the 10th April 1881, from which date the ordinary observations have been regularly taken. I visited the observatory in November, to ascertain whether the anemograph house, the cost of erection of which had been sanctioned by the Assam Government, was progressing. I found that little had been done, and that the probability of its being completed during the official year was very doubtful. Afterwards, however, acting under instructions received from the Chief Commissioner of Assam, the Executive Engineer pressed forward the work, and the building was completed on the 17th of March 1882, and handed over to the

Meteorological Department. Several fairly satisfactory traces have already been received from Dhubri. The Dhubri Observatory was generally in very good order, and as its position is an open one, and the Observer is careful in his work, it will furnish, I have little doubt, a series of valuable observations.

Mr. Pedler inspected the Bankipore Observatory in February. This observatory is, I regret to state, in a less satisfactory condition than it ought to be. It was stated in the last report that, with a view to retaining the services of the Observer, who has been many years in the Department, arrangements had been made for the removal of the observatory to a suitable site in the Temple School of Medicine, on condition that the Observer and Assistant Observer should take simultaneous readings of the thermometers at the old and new sites, for twelve months, to enable me to determine the temperature differences between the old and new sites. By this plan, it would have been possible to make comparison between the future temperature returns of Bankipore and the past returns. A letter was received from the Superintendent, in August, stating that the Telegraph Department were erecting a building quite close to the old observatory, and that this circumstance affected the readings of the thermometers so much, as to render the simultaneous readings useless for the purpose of comparison. As it was impossible for me to visit the observatory at that time, I could only act on the opinion of the Superintendent, and gave orders that readings at the old observatory might be discontinued if his statements represented the exact facts of the case. This was accordingly done. The additional observations ceased on the 31st of August. When Mr. Pedler went to visit the observatory I asked him to ascertain whether the circumstances were such as to justify the discontinuance of the simultaneous observations. His remarks on the point are:—

"The position of the old observatory, with reference to the new Telegraph buildings, was inspected, and the minimum distance was found to be about 60 feet. There would, therefore, not appear to have been the necessity for discontinuing the comparative observations between the old and new observatories on 1st September 1881, which was indicated in letter No. 401, dated 1st August 1881, from the Civil Surgeon."

I regret this much, as it confirms an impression I received on my last visit to the Bankipore Observatory that the Observer is careless about his meteorological work, now that he has been allowed to combine with it the more remunerative duties of Head Clerk in the Temple School of Medicine.

The following is Mr. Pedler's inspection report of the observatory:—

"Inspected the Patna Observatory at the Temple School of Medicine, on 26th February 1882. The instruments, on the whole, were not in such good working order as they ought to have been. Most of the thermometers were in good order, but the wet bulb hygrometer showed slight signs of an encrustation on its surface. The Observer, however, said that only rain water had been used for moistening the muslin. The thermometer shed, though not accurately of standard pattern, appeared a fairly good one; except that the thatch is thin on the south end at the ridge, and that the eaves are rather too high above the ground. The barometer is in an excellent position, and is in excellent working order; but the Observer, in recording it, was not careful to read to the highest point of the meniscus. He seemed to have a personal error of about ·008 inch.

"The anemometer was in good order, but the wind-vane had evidently not been oiled for a long period, and it worked with much friction. There is little doubt that the recent observations of wind-direction are not to be implicitly depended on. The direction of the pointers is correct. The rain-gauge is rather too near the fencing round it, and the bottle and funnel were dirty.

"The grass radiation pad had been used by the Observer since 1st September 1881, without removing the covering of waxed-cloth in which it had been sent to him by post. It is difficult to say whether this was due to carelessness or ignorance."

From the above report, it is evident that the state of the observatory is anything but creditable to the Observer. The unoiled state of the wind-vane, the dirty condition of the rain-gauge, and the encrustation on the wet bulb thermometer, are evidences of continued carelessness and neglect on the part of the Observer, which it is only fair to assume would also shew itself in his work of observation, as well as in the condition of his observatory. The condition of the observatory as reported last year (*vide* Administration Report) was not altogether satisfactory. I found that the anemometer was improperly and imperfectly fixed, and that, consequently, the returns of the wind-velocity were valueless for the whole of the preceding year, at least. The condition of the observatory has, judging from Mr. Pedler's remarks, evidently deteriorated during the past year. This has also been shewn by the frequent delays in the submission of the meteorological returns, and by the numerous mistakes which have been found in them by my office. If a change for the better does not take place, it may be necessary for me to advise the reduction of the Patna Observatory from the second to the third class. This would effect a saving of at least Rs. 55 per mensem, which might be spent in establishing two more third-class observatories, one in Northern Bengal and the other in Eastern Bengal, both of which districts are imperfectly represented in our meteorological system, as compared with West and South-West Bengal.

The Saugor Island and Cuttack Observatories are the best of my second-class observatories, and have worked very satisfactorily during the whole year. Dhubri and Chittagong came next in order of merit. Sibsagar is nearly equal to the last two in character of work, so far as I can judge by the returns. I regret I have been as yet unable to visit that station. The remaining two, Hazaribagh and Patna, are not, at present, as satisfactory as they ought to be. Both send in returns with numerous mistakes, and the returns are usually not received, until considerably after the proper time; so much so as to occasionally delay the publication of the monthly abstract. I regret to say that I have found it necessary to fine both Observers for delay during the past year.

Third-class Observatories.—These are twelve in number. Ten are situated in Bengal, one (Akyab) in Burma, and the remaining one (Silchar) in Assam. The conditions of these observatories are identical with what they were as stated in last year's report.

The following table gives the list of the third-class observatories, together with the names of the Superintendents and Observers during the year 1881-82:—

Third class Observatories.

Stations.	Superintendents.	Observers.	Observers' allowance.
			Rs.
Darjeeling, St. Paul's School.	R. Carter, Esq., Rector, St. Paul's School.	Mr. W. T. Moore [1]	25
Purneah	Dr. Picachy	Babu Russicklal Basu [2] . . .	15
		„ Brojo Nath Sanyal [3] . . .	
		„ Russicklal Basu [4] . . .	
Durbhanga . . .	„ J. C. Shaw	„ Jogin Chandra Banerjee *. .	...
	Babu Gopal Chandra Chatterjee, M.B.		
	Dr. N. J. Halpin		
	„ J C. Shaw		
	„ J. F. Mullen		
Gya	D. R. MacLeod	Nowrungee Lal	15
Berhampore . . .	Dr. S. M. Shircore	Babu Mahendra Nath Roy † . .	15
Burdwan . .	Baboo Dinobundhu Dutt [5] . . .	„ Mokhoda Prosad Chowdhury † .	15
	Dr. J. O'Brien, M. D.		

---

[1] From 1st October, when the observatory was established and commenced work.

1s April to 31st May 1881.

[3] 1st June to 31st August 1881.

[4] Since 1st September 1881.

[5] 1st April to 28th May 1881.

* Is to receive an allowance of Rs. 5 per month from the 1st April 1882 for good services.

† These officers are to receive the special allowance of Rs. 10 each per month from 1st April 1882.

Third-class Observatories—continued.

Stations.	Superintendents.	Observers.	Observers' allowance.
			Rs.
Jessore	Dr. A. Barclay[6] „ Taruk Nath Gangooly[7] „ D. W. D. Comins[8]	Baboo Poresh Nath Rai Chowdhuri	15
Dacca	....	Mr. E. D. Shave	25
Silchar	„ J. J. Monteath	Baboo Romesh Chandra Bhadra[9]	15
		„ Mahendra Chandra Dutt[10]	...
Dimagiri	....	„ Kunja Behary Nundy[11]	...
		„ Nobin Chandra Ghose[12]	...
False Point	....	G. S. Adshhead[14], H. W. Ally[13], J. P. Allen[15].	30
Akyab	....	Mr. J. M. Bennett	25

No change has been made in the character of the observations taken at these stations. They are, with perhaps the exception of Purneah and Cachar, in a fairly satisfactory state. They require frequent inspection, as there is always a tendency on the part of the native Observers at these observatories (who are not very highly paid) to allow their instruments to get into a dirty state, and to take their observations in a careless and perfunctory manner, and after methods of their own invention, instead of those laid down very fully and clearly in their code of instructions, the *Vade Mecum*.

Four only of these observatories were inspected during the year, *viz.*, Burdwan, Jessore, and Berhampore, by Mr. Pedler, and Darjeeling by myself. Mr. Pedler's inspection report of the Burdwan Observatory is as follows:—

"Inspected the Burdwan Meteorological Observatory, and found all the instruments in excellent order and well placed as to exposure, &c. The wind-vane erected by the Public Works Department on a new tower, appears to be about 7° west of the true north. The records of the observatory are also well kept. The Observer himself appears to be very intelligent and well up to his work, and the observatory, as a whole, is in excellent condition."

The Burdwan Observatory has thus quite kept up its previous reputation, and the Observer has well earned, by the accuracy of his observations and the care he has taken of his instruments, the increment to his meteorological pay, which was granted to him, in accordance with the circular of the Meteorological Reporter to the Government of India of the 23rd November 1881, from the 1st of April 1882.

Berhampore was visited by Mr. Pedler on the 19th of February. The necessity of a reconstruction of the shed at that station was pointed out in my last Administration Report. Plans and estimates were submitted and sanctioned after the termination of the rains. The new shed was not quite completed at the time of Mr. Pedler's visit. It has since been finished, and the conditions of observation at Berhampore are now similar to what they are at other observatories. Mr. Pedler's report of his visit is as satisfactory as it is brief. He says:—

"Inspected the meteorological observatory at Berhampore. The Observer understands his work well. All the instruments were in good working order, though the new thermometer-shed was not finished. When completed, it will be a very good and substantial structure. The office records are also in excellent order."

---

[6] 1st April to 8th August 1881.
[7] 9th August to 20th October 1881.
[8] 21st October to 31st March 1881.
[9] 1st April to 19th September 1881, and since 21st November to 31st March 1882; was on privilege leave from 20th September to 20th November 1881.
[10] 20th September to 20th November 1881.
[11] 1st April to 25th November 1881.
[12] 25th November to 31st March 1882.
[13] 1st April to 13th July 1881, from 30th August to 5th December 1881.
[14] 14th July to 29th August 1881.
[15] 6th December to 31st March 1882.

The Berhampore Observer has been thirteen years in the Bengal Meteorological Department, and has always taken great interest in his work, and spared no pains to maintain his observatory in excellent condition. He has also received one of the increments of ten rupees per mensem for good work.

Mr. Pedler inspected the Jessore Observatory on the 12th February. The following are his remarks:—

"Inspected the meteorological observatory at Jessore on 12th February. The Observer was punctual in his attendance, but the observatory has not keen kept in good order by the Observer. The follow instances are sufficient to prove the want of attention of the Observer to his work and to the rules:—

"*First.*—There had been a slight separation of the column of mercury in the solar-radiation thermometer, which amounted to about 1·8°, and which had not been noticed by the Observer. This mercury was at the top of the tube, and therefore the readings are affected to that extent.

"*Second.*—The rim of the funnel of the rain-gauge had become separated from the collar, and this had not been reported. The funnel edge was not horizontal.

"*Third.*—The graduations of the wet-bulb thermometer or hygrometer were very indistinct.

"*Fourth.*—The cloth pad of the grass-radiation thermometer was in rags.

"As minor faults, I would mention that the ventilation hole of the thermometer shed wants repairing, that the cloth used to cover the bulbs of the two wet-bulb thermometers was too thick and coarse, and that the anemometer, although working fairly well, was scarcely sufficiently oiled."

The Jessore Observer was trained at Calcutta, and is thoroughly competent to do his work well if he chooses to take an interest in it. The state of the observatory, as described by Mr. Pedler, shews that he has been very careless—an inexcusable fault in an Observer. I hope when I visit this station next year to find a marked improvement in the condition of the observatory. If not, it will then be necessary to adopt more severe measures to ensure accuracy of observation at Jessore.

I visited the Darjeeling Observatory on the 20th and 21st of November. Sanction was obtained last year to the removal of the observatory from the Telegraph buildings to St. Paul's School, and for the erection of a suitable shed in the grounds of the school, and of a small building on the highest point of the grounds for the reception of the Casella's anemograph, originally intended for Patna. The observatory shed was finished in September, and the work of observation commenced on the 1st of October. There was some delay in the erection of the anemograph house in consequence of the Military Department contemplating the purchase of that portion of the grounds of St. Paul's School on which it was to be placed. As the Military Department finally decided to purchase the Lebong estate, the house was erected and finished on the 20th of March 1882. The sites of the observatory shed and of the anemograph house are very open, and the observations will be, I believe, of a high order for accuracy and value. Darjeeling is the only Indian hill station which has as yet been furnished with a self-registering anemograph, and its record will probably give valuable information of the daily changes of wind in the higher strata, consequent on the changes in the lower strata indicated by the diurnal oscillation of the barometer.

Burdwan and Berhampore are excellent observatories. Dacca and False Point, both under the care of Telegraph Masters, are, so far as I can judge from the returns of the past year, nearly, if not quite, equal to these two in the character of their work, and the carefulness and readiness with which the various returns are submitted.

The Akyab Observatory is not quite so satisfactory. Frequent mistakes are made by the Telegraph Master in the transmission of his weather telegrams.

Durbhanga, Gya, and Jessore follow next in order of merit. The work of the Silchar and Purneah Observatories during the past year, on the other hand, is not at all satisfactory. Mistakes frequently occur, and the Observers, I regret to say, appear to be specially slow in acting upon any hints, sent from the head office for the improvement of the observations. Hence the observations sent from these two stations are always open to a suspicion of want of accuracy, and are much less valuable than they ought to be. This is much to be regretted, as both stations are somewhat difficult of access, and hence defects of observation at these stations tend to become permanent. On the other hand, they represent large and important areas, and defective or inaccurate observation for these areas, virtually excludes them from any advantages that are likely to follow from the accurate registration and continued study of meteorological observations. Cachar, moreover, is a very expensive station. The annual cost of petty repairs is more than twice that of any other station in my province. The explanations given, of the great cost of the repairs at that station, have never appeared satisfactory to me. If the means of rapid communication with Cachar are not established in the course of a year or two, it may be desirable to remove the observatory to a more accessible station. At present I consider the money spent in maintaining the Cachar Observatory as wasted.

Rain-recording stations.—These are 161 in number, as was noticed in the last report, and include the great majority of the revenue stations. During the course of the year, Chanchal in Maldah and Sonbursa in Bhagalpore were closed; but the establishment of two new stations, one at Baloorghat in Dinagepore, and the other at Kalimpong in Darjeeling, served to keep up the number of the rain-recording stations of last year. The rainfall returns are made up and forwarded weekly, and are generally sent in with punctuality, and thus enable me to publish the monthly return of rainfall in the Gazette, in the third or fourth week of the ensuing month.

Instruments.—The following tables give returns of the instruments broken or rendered unserviceable by other causes than ordinary use at the Bengal Observatories during the year 1881-82, and of the instruments supplied to replace broken instruments or instruments which have become inaccurate from prolonged employment:—

Return of Instruments broken or otherwise injured at the Observatories in Bengal and Assam, 1881-82.

		HYGROMETER.			MINIMUM THERMOMETER.		RADIATION THERMOMETER.											
	Barometer.	Dry.	Wet.	Dry maximum.	Dry.	Wet.	Solar.	Grass.	Anemometer.	Wind-vane.	Rain-gauge.	Measure-glass.	Standard thermometer.	Lens.	Lantern.	Clock.	Anemograph.	Bottle for gauge.
Purneah	...	...	...	1	1	1*	1*	1†	...	...	...	...	1	...	...	...	...	...
Burdwan	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Patna (new station)	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cuttack	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Chittagong	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Berhampore	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Sibsagar	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1§	...	...
Dhubri	...	...	...	...	...	...	1*	...	...	...	...	...	...	...	...	...	...	...
Cachar	...	...	...	...	...	...	1*	1†	...	...	...	...	...	...	...	...	...	...
Darjeeling	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...
,, St. Paul's School	2*	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...
Jessore	...	...	...	...	...	...	1*	...	1‡	...	1‡	...	...	...	...	...	...	...
Akyab	...	...	...	...	1*	...	2	...	...	...	...	...	...	...	...	...	...	...
Saugor Island	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
Gopalpore	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hazaribagh	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...
False Point	...	...	...	...	...	...	...	...	1†	...	...	...	...	...	...	...	...	...
Dacca	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...
Durbhunga	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Gya	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Returned out of order. † Returned broken. ‡ Returned for repairs. § Unserviceable and sold by auction.

The instruments which have hitherto required most frequent renewal are mininum (alcohol) thermometers and radiation thermometers. The latter instruments (*i. e.*, the solar radiation and terrestrial radiation thermometers) are exposed in the open for a portion of the day. They are liable to breakage by exposure, at unusual and unauthorized hours, by sudden hail-storms or gusts of wind, &c., and by the destructive tendencies of boys, cattle, &c. They also occasionally disappear at second-class observatories, when the Observer and his Assistant Observer are not on good terms. The number of these instruments replaced during the year is, on the whole, a fair index of the care which the Observer has taken of his instruments during the year. The above statement shews that Burdwan, Dacca, Gya and Durbhanga required no instrument to be supplied to them during the year. Purneah, Cachar, and Hazaribagh, all of which stations are not in so satisfactory a condition as I would wish, were each supplied during the year with two radiation thermometers. Berhampore, Chittagong, Sibsagar, and Akyab each required one radiation thermometer. The amount of breakage seems to me much greater than it might be, if the Observers, as a rule, were as careful as they ought to be in looking after the safety of these instruments. Stricter rules respecting the conditions of supplying instruments to replace broken or worn-out instruments appear to me to be imperatively necessary.

Central Office.—The office staff of the Bengal Meteorological Department consisted of the following on the 31st March 1882:—

Names.	Ranks.	Salary.		
		Rs.	A.	P.
Babu Fanindra Mohan Basu	Head Clerk in charge	......		
„ Chundi Churn Chatterjee	Head Clerk from 24th August 1881	75	0	0
„ Poorno Chunder Mookerjee	Second Clerk	41	0	0
„ Debendra Nath Banerjee	Third do.	25	0	0
„ Kamini Mohun Basu	Tabulator	30	0	0
„ Jogesher Roy	Do.	20	0	0
„ Banikant Roy Chowdhury*	Do.	......		
„ Surendra Nath Banerjee	Offg. do.	20	0	0

* On deputation to Jubbulpore since 21st February 1882 for one year.

Babu Franindra Mohun Basu, Head Clerk of the India Meterological Office, was, until the 24th of August 1881, also Head Clerk of the Bengal Meteorological Office. The increase in the amount of work of the two offices, due to the various extensions recently made to the Department, rendered it necessary to place the two offices under separate Head Clerks. The proposal was sanctioned by the Government of India, and came into effect from the 24th of August.

The regular and systematic work of the office consists in the reduction of the observations of the Bengal and Assam stations, and their tabulation in the prescribed forms, for the preparation of the various returns of the Bengal and Indian Meteorological Reporters. The Bengal Office has prepared and published the following returns, during the year, in the *Calcutta Gazette*:—

(I.) A monthly summary; giving the averages or totals of the observations taken at the twenty observing stations in Bengal and Assam.

(II.) A monthly return of the rainfall, giving the rainfall of each day of the month and a comparison of the total rainfall of the month, with the averages of previous years at 161 revenue stations in Bengal.

(III.) A table shewing the monthly and annual rainfall in Bengal for 1881, at 167 revenue stations in Bengal.

(IV.) A table shewing the average monthly and annual rainfall at the revenue stations in Bengal.

(V.) Comparison table of the rainfall of 1881 at the revenue stations in Bengal, with the averages of the past years.

In addition to the regular routine work, the office has prepared the materials for two meteorological investigations, which I have undertaken during the past year. The first of these is an enquiry into the probable relations between the abnormal variations of pressure over India during the pre-monsoon period, March to May, inclusive, and the abnormal distribution of rainfall during the succeeding south-west monsoon months, July to September, inclusive. The comparison of the two shews that in every year out of the seven years for which it was made, except perhaps one, the connection between the two is what I indicated, from theoretical considerations, in my note on recent south-west monsoons, published in the year 1878; and that therefore, generally, a fair indication of the probable distribution of the south-west monsoon rainfall can be obtained by a study of the barometric variations during the pre-monsoon months.

One other interesting result, which I had also anticipated, seems to be established by the same investigation, *viz.*, that the abnormal variations upon which the local distribution of rainfall appear largely to depend, are usually generated and developed, or, if already existing, are intensified, during the period of greatest contrast of meteorological conditions over the Indian area, *viz.*, in the dry and hot weather months, whereas the effect of the approximately uniform conditions of great humidity and general uniformity of temperature of the rainy months, is to diminish the abnormal barometric variations, general and local, and to cause them to disappear when they are small in amount.

The second investigation was commenced, with the object of ascertaining the existence and character of the regular oscillatory changes of atmospheric pressure in India, other than the annual and diurnal oscillations. A cursory examination of the observations, published in the Indian Daily Reports, shews that the atmospheric pressure is in a state of constant oscillation, in the cold weather months as much as in the hot weather months, and in the dry season of the prevalence of the north-east monsoon, as well as during the humidity of the south-west monsoon. This more or less regular movement of the barometric column is due to pressure changes of the atmosphere, equally regular; produced either by alternate expansion and contraction, or other oscillatory movements. These changes, when combined with other conditions, may give rise to the general and local irregularities which constitute what may be called the weather at the time as distinguished from the regularities known as climate. On the other hand, they may take place and be of considerable amount, without any apparent irregular action in the atmosphere whatever. If this be true, it is essential, if the pressure changes are to be employed as one of the elements in the provision of weather, that these regular oscillatory movements of the atmosphere, intermediate between the diurnal and the annual period, should be estimated, and, if necessary, eliminated. This would be equally necessary in dealing with such a question as the relation between changes of the atmospheric pressure and the phenomena of storms.

These two investigations are practically completed, and ready for publication in the Indian Meteorological Memoirs.

As has been already stated, the work of the two Meteorological Offices (India and Bengal) has increased to such an extent as to render it necessary to engage a separate Head Clerk for the Bengal Office, and to limit the duties of Babu Fanindra Mohun Basu to the working of the India Meteorological Office. As Babu Fanindra Mohun Basu has performed the duties of Head Clerk of the Bengal Office for nearly twelve years, I cannot allow the opportunity of the severance of his connection with the Bengal Office to pass, without expressing my sense of the zeal and ability with which he has discharged his duties in that capacity for so many years. It is very largely owing to his power of work and control over the clerks in the office, that it has adapted itself readily to the expansive changes which have been made in it since its establishment, and that it has always been equal to the various duties imposed upon it by Government, and that there has never been any accumulation of arrears in the work of the office.

Storm signals.—The weather in the Bay of Bengal, during the past year, was unusually quiet and free from storms. The south-west monsoon was established without the occurrence of any violent cyclone. During the south-west monsoon, a succession of small cyclonic vortices or south-west monsoon storms advanced across the coasts of Bengal and Orissa. Only one of these, however, seemed to me to be of sufficient magnitude and importance to justify the hoisting of the bad weather signal. This was at noon on the 15th July, and the signal remained hoisted up for about 48 hours, or until noon of the 17th July. The south-west monsoon terminated without any cyclone or severe gale at the head of the Bay; but as it retreated southwards in November, it gave rise to a remarkable cyclone in the south-west angle of the Bay. It was of very small intensity, as judged by the depression of the barometer at and near its centre. It was, however, accompanied by unusually strong winds and an excessively high sea, both out of proportion to the barometric depression; and, as a consequence, the Madras pier, which had withstood a previous cyclone of much greater intensity, (as judged by the barometric depression at its centre), was greatly damaged and partly overthrown.

I submitted an extended code of signals for giving more precise intimation respecting the character of approaching cyclones to the shipping in the port of Calcutta and River Hooghly, to the Government of Bengal, in the month of November last. It is, I believe, still under consideration.

Daily weather reports.—These have been published, during the past year, in the same form as was adopted originally in April 1880. They continue to give a Weather Chart of the Bay, together with the original observations, as taken at sixteen stations round the Bay, and a brief summary of the weather at that hour; and a forecast, when necessary, of the approach of storms towards the head of the Bay.

The reports were supplied to 27 paying subscribers and to 18 Government officials, at the commencement of the year; and, at the end of the year, to 27 subscribers and to 23 Government officials, making in all 50 copies distributed daily. There is a small balance in hand, after paying all expenses, which I am reserving to meet the cost of repairs of the occasional breakages of the lithographic presses. These are by no means unfrequent, as the work requires to be hurried through after my college work, in order that the report may be published and circulated before 4 or 5 P.M.

Maritime Meteorology.—During the past year, the Government of India called upon the Meteorological Reporter to the Government of India to submit proposals for the extension of the work of his department, in accordance with the suggestions of the Famine Commission. Amongst these proposals was one for the establishment of a small Branch Department of Maritime Meteorology, in connection with the India Meteorological Office, and which he proposed should be placed under my superintendence. These proposals were sanctioned, with effect from the 1st of April 1882. While the matter was under discussion, it was not considered advisable to extend the work of Maritime Meteorology commenced last year, but simply to continue it on the same footing. Hence, the work in this Department has been confined to the collection of observations taken on board the light-vessels, and to the examination of one portion of the observations in Indian seas, collected by the Board of Trade in England, and sent out here a short time ago. I have, however, received during the year meteorological extracts from the logs of several vessels entering the port through the kindness of S. R. Elson, Esq., Master Pilot, and of the captains of the vessels themselves, many of whom appear to be willing and ready to give any assistance in their power to the Meteorological Department.

In connection with this work, I have prepared a full report on a south-west monsoon storm which occurred at the head of the Bay, and passed into Central Bengal in September 1878. The materials for the discussion of this storm were collected by Mr. Pedler, and as it appears to me to be a typical case, I have devoted some time to a careful examination of the meteorological conditions and phenomena of the storm. The report is ready for publication in the Meteorological Memoirs, and will probably be printed and distributed during the present year.

FINANCE.

The following statement gives the total cost to the State of the Bengal Meteorological Department during the year 1881-82:—

	Rs.	A.	P.	Rs.	A.	P.
Meteorological Reporter	3,600	0	0			
Office establishment	2,516	8	7			
Office rent	900	0	0			
Observers — Telegraph Masters[1]	2,655	0	0			
Observers — Native Observers	3,113	0	0			
Messengers' allowances	48	0	0			
Superintendents' allowances	1,440	0	0			
				14,272	8	7
CENTRAL OFFICE.						
Contingent and office furniture	538	0	3			
Postage	250	4	6			
Telegraphic messages	6,670	3	0			
Travelling allowances	512	4	0			
				7,970	11	0
OBSERVATORIES.						
Building and repairs	2,304	2	9			
Contingent	93	0	6			
				2,397	3	3
GRAND TOTAL				24,640	7	7

The total is considerably larger than it has been for previous years. The increased cost of the office establishment is due mainly to the addition of a Head Clerk, sanctioned by the Government of India from the 24th of August 1881. Office-rent has hitherto never been included in the statement, through some oversight, but is now given for the first time. An additional charge, *viz.*, that for Telegraph Masters, who also perform the duties of Observers (and whose meteorological allowances are budgetted for and paid directly by the Telegraph Department, the total amount being debited to the Meteorological Department by a book transfer at the end of the official year,) also appears for the first time. The item "Telegraphic messages" is also somewhat larger than it was last year. This is due to the fact that, the weather telegrams despatched for the use of the Calcutta Storm-signal service were converted from "Service precedence bearing messages" to "Urgent messages," on or from the 1st January 1882, and now cost Rs. 2 instead of 1, as hitherto, for each telegram.

The item "Building and repairs" is considerably larger than it has hitherto been. The expenditure, under this head, for the past year has, however, been special in character, and is not likely to occur again for many years at least. It includes the cost of erecting two substantial buildings, to house self-registering anemographs, at Dubri and Darjeeling, and an observatory shed at Darjeeling. The cost of the Dubri building was Rs. 999, and of the Darjeeling building and shed was Rs. 698-8. The shed hitherto in use at Berhampore has, as already stated, been replaced by a new and substantial one.

The statement does not include the cost of instruments supplied to the observatories by the Indian Meteorological Department; nor does it include the cost of stationery supplied to the central office, or of printing the various forms required by the office, nor of printing the meteorological returns published in the Gazette or otherwise.

JOHN ELIOT, M. A.,
Meteorological Reporter, Government of Bengal.

METEOROLOGICAL OFFICE, BENGAL,
The 15th April 1882.

---

[1] Paid through the Telegraph Department.

APPENDIX B.

Administration Report of the Meteorological Reporter to Government, North-Western Provinces and Oudh, for the year 1881-82.

THE administration of the Meteorological Department in these provinces, during the year under report, continued on the same lines as in previous years. The only change in the number of observatories was the addition of one of the voluntary class at the Opium Factory, Ghazipur. Observations had been taken in a desultory way there for several years; but from the 1st January last, Dr. Weir, the Officiating Principal Assistant to the Opium Agent, commenced them on a regular system, and has since sent in monthly reduced registers, which agree closely with those of the neighbouring station, Benares.

Observatories.—The observatories now stand as follows: —

How maintained.	Class of observations they furnish.		
	First class.	Second class.	Third class.
By Meteorological Department	Allahabad (in abeyance)	Allahabad (temporary). Lucknow. Agra. Roorkee.	Chakráta. Ránikhet. Bareilly. Gorakhpur. Benares. Sutna. Jhánsi. Ajmere. Sambhar.
By other Government Departments	...	...	Dehra [1]. Gházipore [2].
Voluntarily or by Independent States, &c . . .	Jeypore (in part)	Jeypore [3]	Meerut [4]. Nowgong [5]. Pauri [5]. Pithoragarh [5].

[1] Maintained by Survey Department.
[2] Ditto Opium Agency.
[3] Ditto State Darbar.
[4] Maintained by Municipality.
[5] Observers unpaid.

The observatory at Sambhar, in Rajputana, which was established two years ago by the Inland Customs Department, has now been added to those which draw an Observer's allowance from the Meteorological Department allotment.

The twenty observatories named in the preceding list, may be classified into fifteen in the North-Western Provinces and Oudh, three in Rajputana, and two in the Central India States; also into five in the Himalayas, nine on the Gangetic plains, and six on the higher country south-west of the Jumna. There are also two observatories of the voluntary class at Mussooree, which report directly to the Meteorological Reporter to Government of India. The Himalayan Districts of the North-Western Provinces have thus seven observatories now, in all, but none of these are near the snows, the farthest back among the mountains being those recently established at Pauri and Pithoragarh. The system of observatories for the whole region would be very complete if there were a good observatory near the snows and another somewhere in the north of Oudh, between the Sarju and the Nepal frontier. The latter may perhaps be established, when the Patna-Bahraich Railway is opened; but there will always be a difficulty about the former, because most of the higher villages are deserted in winter.

In the classification of the observatories according to the nature of the observations they furnish, Class I. means that they register temperature, pressure, wind-direction and movement, &c., autographically; Class II., that eye observations are made three times daily, at 10 A.M. and 4 P.M., and at, 7 A.M., Washington time, the latter being intended for the United States International Weather Bulletin; also that hourly observations of the instruments are recorded on four days in each month. At stations of the third class, only the 10 A.M. and 4 P.M. observations, with rainfall and general weather observations at 6 P.M., are recorded. There is yet no fully equipped first-class observatory in Upper India.

Allahabad Observatory.—The building for the first-class observatory at Allahabad has not yet been commenced. Plans have been drawn and sites been chosen again and again, but still no progress has been made; the last cause of delay being a reference to Mr. Emerson, the English architect who designed the Muir College, where it was proposed to erect the observatory, and who objected to any addition that was not designed by himself, so as to be in harmony with the rest of the building. Meantime, as the present temporary site must be vacated before long, a thermometer shed has been run up near the College, and from the commencement of the current year, observations have been made there, for comparison with those recorded at the old observatory. It is possible that the first-class observatory may not be erected at Allahabad after all, but at Cawnpore, a station much nearer to the centre of the country; but, in any case, the Allahabad Observatory will be maintained on its present or a reduced scale, and the temperature comparison now instituted will therefore not be lost.

Jeypore Observatory.—The rapid progress made at Jeypore during the year, contrasts favourably with the interminable delays experienced at Allahabad. In the appendix, will be found a short note on the working of the observatory, drawn up by the Superintendent, Dr. Hendley, for the information of the Viceroy, at the time of His Excellency's visit in November last. It may be added that a handsome building, with a tower 50 feet high, is being erected for the accommodation of the meteorograph there being five rooms in the basement, intended for varnishing, engraving, printing, and various other operations subsidiary to the actual registration effected by the instrument. This building is now almost finished; and the instrument may be expected to yield valuable traces during the current year. In addition to the soil thermometers mentioned in Dr. Hendley's note, another one, giving the temperature 20 feet below the surface, has been read daily since the beginning of January. A record of these observations, as well as of the soil temperatures at Allahabad, will be found in the appendix.

Inspection of Observatories.—When on leave last May, I made an informal visit to Ranikhet, and found everything connected with the observatory there in fair order. Later on, I passed through Pauri, and set up the instruments at the new observatory there; and afterwards I visited Mussooree and determined the elevation of the barometer cistern at the St. Fidelis' Observatory. At the same time, Mr. Boutflower, who officiated for me, visited Roorkee and Chakrata. On my way back to Allahabad, in June, I inspected the observatories at Bareilly and Lucknow. In the first week of December I visited Sutna, where I found everything in good order, except a Casella anemograph, that had been recently set up; and afterwards I inspected Benares and visited Ghazipur, where I determined the errors of the barometers and thermometers that were in use. At the end of December, I started on a tour round the Rajputana stations, visiting Agra, Jeypore, Ajmere, and Sambhar.

Neither Mr. Boutflower nor I found much to complain of in the general condition of the observatories we visited, the instruments being, as a rule, clean and in good order. The least satisfactory station was Ajmere, where the thermometer shed had fallen in May, luckily without damaging the instruments, and had been rebuilt in such a fantastic and unstable-looking style, that it will probably come down again when a dust-storm strikes it. For want of a protecting railing, the radiation thermometers had been stolen shortly before my visit, though the ground where they were exposed is close to the beat of the sentry on guard over the treasury. For these accidents the Observer was not to blame, but he had neglected to keep a double register of rainfall, as directed at the time of my previous visit—one by the old gauge, 40 feet above the ground, and the other by a new instrument one foot above the ground. The Superintendent promised to get a railed enclosure erected at once, for the protection of the thermometers, so that now I hope the condition of the observatory is improved in this respect. In every other way, the Ajmere Observatory has worked very well; the weather telegrams, for example, being always punctual and accurate.

Verification of Instruments.—Mr. Boutflower tested the barometers and thermometers at Roorkee and Chakrata, but found no errors of any consequence, except a rise of about 0·4° in the standard thermometer at Roorkee, which has been in use many years. At Ajmere I also found that a slight rise in the freezing point of the mercurial thermometers had taken place since they were first issued. When at Ghazipur, as above stated, I determined the errors of the instruments belonging to the Opium Department, and I also tested two or three thermometers at Jeypore.

The difference in the reduced readings of the barometers of Jhansi and Nowgong, mentioned in last year's report, was found not to be due to any instrumental error, but to an error in the supposed elevation of Nowgong above sea-level.

Special Instruments, &c.—The clock of the barograph at Allahabad was out of order for a short time, but the instrument is again working regularly. The earth thermometers have been observed four times every day, and the results are given in a table in the appendix. When the temperatures of the soil at Allahabad, from the commencement of the series, are freed from annual variation, they indicate a gradual and very regular, though slight, decrease, completely in accordance with the known law of the variation of temperature in tropical countries during the sun-spot cycle.

The means for the years whose middle points lie at the middle of each of the following months were :—

Epoch.	Temperature of			
	Air in shade.	Ground surface.	Ground 1 foot deep.	Ground 3 feet deep.
November 1880	77·52	83·30	81·59	82·20
December "	77·33	82·91	81·51	82·24
January 1881	77·17	82·54	81·37	82·19
February "	77·13	82·51	81·36	82·19
March "	77·07	82·47	81·36	82·21
April "	76·97	82·22	81·24	82·17
May "	76·80	81·77	80·98	82·02
June "	76·75	81·52	80·89	81·94
July "	76·85	81·46	80·96	82·02
August "	76·75	81·23	80·93	82·08
September "	76·80	81·05	80·87	82·07
Mean	77·01	82·09	81·19	82·12

On the mean of the whole series, the temperatures at the surface and at three feet depth are almost identical, and are five degrees above the temperature of the air. At one foot depth, however, the temperature is nine-tenths of a degree lower than at the surface. The cause of this difference may be, in part, a difference in the form of the diurnal variation at the surface and one foot deep, the mean of four observations, at 4, 10, 16 and 22 hours, giving very nearly the true daily mean at the surface, but being somewhat too low at a depth of one foot. To test this, hourly observations will be made on four days each month during the present year. The difference between the surface temperature and that at one foot depth decreases so considerably between November 1880 and September 1881 that it may be due to the cool wave of 1879, followed by the hot wave of 1880, that was superimposed on the general decrease of temperature which has recently occurred and is now taking place. The high temperature of the three feet thermometer, at the commencement of the series, may represent the heat of 1878, and that at the surface the heat of 1880, while the lower temperature, at a depth of one foot, may be due to the cold of 1879. This would mean extremely slow conduction of heat from above downwards; and against this view may be set the slight increase of temperature after June 1881, which occurs simultaneously in the air and in the two lower soil-thermometers, but, strangely enough, is not apparent at the ground surface.

The Beckley anemograph at Roorkee worked thoroughly well, and we have now two volumes of traces from it waiting to be measured and tabulated. That at Lucknow never worked satisfactorily in the place where it was first put up, but since the 7th August it has been erected in a new position and now works admirably. The embossing instrument of Casella's construction, set up at Sutna on a building specially erected for it, has not given traces of any value. It would probably work very fairly in England or at a sea-coast station in India, but, for the interior of the country, it has the fatal defect of depending on the movement of the wind to carry forward the recording paper. Consequently, at night, when light winds and calms prevail, the hammer which embosses the direction mark, comes down hour after hour on the same spot, and twenty-four distinct impressions are hardly ever obtained in twenty-four hours. As there is no time-scale, it is impossible to identify the hours to which the several marks belong, and the instrument is thus almost useless.

Character of the Observations.—The mistake of following Madras instead of local time, mentioned in last year's report, has been avoided, and, in most other respects, the observations have been very well conducted. Nevertheless, there are differences in the work of the Observers, which are easily seen by one who has to revise their work. One man's returns are always punctual, neatly written, and in the weather remarks, &c., indicate an intelligent interest taken in the work, while another's do not evidence the same care and interest. Again, one Observer is frequently meeting with accidents to his thermometers of the most varied nature, while, at another station, the instruments are never damaged, accidentally or otherwise. In such matters as making obvious mistakes of ten or twenty degrees in reading a thermometer—mistakes to which the best Observers are liable—there are also very decided differences noticeable. And among the second-class Observers, who reduce their own observations and send in monthly registers, one will hardly ever make a mistake in computation, while another blunders frequently.

With a view to encouraging the best Observers to maintain their position, and to cause the others to emulate them, Mr. Blanford has obtained an allotment in the Budget for the present year, to be spent on personal allowances to those men who are most deserving. The Observers selected for these provinces are those whose names are marked with an asterisk in the list in the appendix. The first three are, this year, to draw an increased allowance of Rs. 10 per month, and the remainder an increase of Rs. 5. These allowances are to be forfeited if the observations deteriorate in character; and presumably, the names of other men who work up to certain standard of excellence may, from time to time, be added to the list, though I have no information regarding this point. If the prospect of a possibility of an equal increase be held out to the rest of the Observers, the system will be a most valuable incentive to good work.

Office and Office-work.—For two months last year I was absent on previlege leave, and the work of the office was efficiently conducted by Mr. W. N. Boutflower, Professor of Mathematics at the Muir College. The work has, however, been gradually falling behindhand, the number of clerks employed being too small to carry on the current work, and, at the same time, prepare the numerous tabular statements and returns, asked for by various authorities in and out of the provinces. Since the supply of meteorological information, when required, to officials and the public is the sole justification for the maintenance of the Department at the public expense, I have always tried to give such information when asked for it; but some people have little idea of the labour they thus throw upon a very small office establishment; and, on one occasion, I have had to decline to undertake the preparation of certain tables asked for, unless on condition that the authority who wanted the tables supplied the clerks to compile them. The simplest way out of such a difficult position would be for Government to increase the strength of the office establishment, and proposals for such an increase will be sent up this year.

The office establishment at the end of the year stood as follows :—

Name and designation.	Monthly pay.
	Rs.
Chintamoney Ghosh, Head Clerk	84
Kalliprosono Datta, Second Clerk	50
Makhan Lal Mookerjee, Third Clerk	30
Ram Charn Pande, Fourth Clerk	20
Sasi Bhusan Banerjee, Fifth Clerk	20
And a peon on Rs. 6 per month.	

It is chiefly in the work of reducing the observations and preparing the registers, copies of which are sent to the Meteorological Reporter for India, that the work has fallen behind. The monthly registers, abstracts of which are published in the local Government Gazette, are now got ready about six weeks after the proper time, and the last copies for the year 1881 were sent to Calcutta as late as the beginning of April. The weekly reports of rainfall, received from the district officers, are always published as soon as possible after they come in; and an annual table, giving the rainfall recorded at each station in 1881, the number of rainy days, and the average for each place, has also been published. This table shews clearly that the district returns are still subject to the errors pointed out last year. Even at the chief stations of districts, all showers of less than a tenth of an inch are neglected; and thus the total rainfall of the year is diminished, sometimes by as much as 20 per cent., while the number of rainy days is made to appear only one-half or two-thirds of the true number. The Provincial Government, having, at last, agreed to supply good gauges to all the chief stations of districts, it is hoped that the errors in the rain records will be less in future than in the past. During the year, gauges were set up at three of the pilgrim dispensaries in Garhwal,—Okhimath, Joshimath, and Karnprayag—all near the snows; and it is hoped that the returns they furnish will in a few years become useful, as a measure of the variations of the snowfall from year to year.

The observations, taken at Allahabad, have been published daily in the local newspapers; and, as in the previous year, a short chapter briefly treating of the meteorology of 1880 was drawn up for the Provincial Administration Report.

In the way of special scientific work, little has been accomplished, owing to the short-handedness of the office. The paper on the meteorology of the North-West Himalaya, mentioned in last year's report, has been reprinted, with certain additions, in the *Meteorological Memoirs;* the corrections to reduce the temperature observations to true daily means have been made out from the records of hourly observations at the second-class stations during the last seven years; all the old temperature registers of the observatories have been revised and corrected accordingly, and some progress has been made in the collection of materials for a general discussion of the temperature of North-Western India. Two short papers, discussing the question of the particular constituent of the atmosphere which has the greatest absorbing power for radiant heat, have been communicated to the Royal Society. In these it is shewn, from certain actinometric observations made at Mussooree and Dehra by Mr. J. B. N. Hennessey, F.R.S., that Dr. Tyndall's conclusion, from experimental evidence, regarding the high absorptive power of water-vapour compared to dry air, is true, though it has often been called in question by meteorologists.

Library.—The additions to the library have been few, and many of them are provincial departmental reports that have no connection with meteorology.

Cost of the Department.—A statement of the cost of the Department under various heads is appended below. The cost of buildings, charged to Provincial Funds, is rendered larger than usual this year by a charge of Rs. 500 for a handsome thermometer shed and ornamental railed enclosure at the Muir College, Allahabad. The charge for travelling allowances, again, exceeded the Budget Estimate, which the Meteorological Reporter for India, I think, fixes too low, but the difference was made up by savings under other heads.

S. A. HILL, B.Sc.,
Meteorological Reporter to Govt., N.-W. P. and Oudh.

ALLAHABAD;
The 5th May, 1882.

APPENDIX B I.

Meteorological Observatory, Jeypore.

THE late Chief of Jeypore, who kept up, for about two years, at great expense, a meteorological observatory within the palace walls, desired to place the readings of his instruments at the disposal of Government.

The position selected by His Highness the Maharaja Sawai Ram Singh was in many respects unsuitable; the Council of the present Prince, therefore, decided to remove the establishment to a situation which would really represent the climatic conditions of (from a meteorological point of view) the unusually interesting country round the capital rather than those of the City of Jeypore, which stands in the entrance of a valley close to low hills.

The present site was selected by Mr. Hill, the Meteorological Reporter to the Government of the North-Western Provinces and Oudh. He considers that it fairly represents the Rajput country, and that the registers taken at the observatory will form a very valuable addition to the meagre data at present available for the elucidation of the meteorology of "Rajputana."

Readings of all the ordinary instruments are taken at intervals of six hours (4, 10, 16, 22 hours) every day, at hourly intervals, four times a month, and synoptic readings once a day, at 5h 5′ P.M., for the American Government.

The temperatures of the soil at the surface and at four different depths beneath it are also read four times a day.

A watchman's detector clock has been purchased, to secure the means of checking the punctuality of the Observers.

An improved Osler's anemograph has been erected in a turret adjoining the meteorological office. This instrument affords a continuous record of the velocity, force and direction of the wind, besides the rainfall.

The Government of India, on the recommendation of Mr. Blanford, has also agreed to transfer to Jeypore, at the cost of the Durbar, a Van Rysselberghe meteorograph, by which all the ordinary meteorological phenomena will not only be registered at intervals of ten minutes, but engraved on a thin metallic band, from which the values may be at once read off, and afterwards, by means of a copper-plate press, any number of copies may be printed for distribution. These results are obtained by the agency of electricity.

The instrument will probably be at work early in 1882, from which time the observatory will be one of the largest in India.

The Agency Surgeon has, for six years past, taken observations, which are comparable with those now registered.

Copies of all records are placed at the disposal of the Government of India.

The annual expenditure is Rs. 2,100.

The Van Rysselberghe instrument will cost about Rs. 4,000.

His Highness the Maharaja, by whose liberality the institution is supported, takes much interest in the daily register which is sent to him.

T. H. HENDLEY, SURGEON-MAJOR,
Superintendent, Meteorological Observatory, Jeypore.

APPENDIX B II.

Names of the Superintendents and of the Observers at the Meteorological Observatories in North-Western Provinces and Oudh, during the year 1881-82.

Observatory.	Class.	Officer in charge.	Date. From	Date. To	Observers.	Date. From	Date. To	Remarks.
Allahabad	Second...	S. A. Hill	1st April 1881	26th April 1881	Kedar Nath Chatterjee,[1] Observer	1st April 1881	31st Mar. 1882	
		W. N. Boutflower, Esq	27th April ,,	25th June ,,	Jadu Nath Chatterjee, Assistant Observer	Ditto ,,	Ditto ,,	
		S. A. Hill	26th June ,,	31st Mar. 1882				
Agra	Ditto ...	Dr. A. H. Hilson	1st April ,,	21st April 1881	Mir Altaf Ali,[1] Observer	Ditto ,,	Ditto ,,	
		Dr. A. Garden	22nd April ,,	25th Nov. ,,	Abdul Mufid Khan, Assistant Observer	Ditto ,,	Ditto ,,	
		Dr. A. H. Hilson	26th Nov. ,,	31st Mar. 1882				
Lucknow	Ditto ...	Dr. J. C. Whishaw	1st April ,,	6th Nov. 1881	Chotay Lal,[1] Observer	Ditto ,,	Ditto ,,	
		Dr. W. A. Cadge	7th Nov. ,,	19th Nov. ,,	Durga Parshad, Assistant Observer	Ditto ,,	Ditto ,,	
		Dr. J. C. Whishaw	20th Nov. ,,	31st Mar. 1882				
Roorkee	Ditto ...	Dr. Murray Thomson	1st April ,,	Ditto ,,	Chiranji Lal, Observer	Ditto ,,	Ditto ,,	
					Tulsee Ram, Assistant Observer	Ditto ,,	Ditto ,,	
Jeypore	...	Dr. T. H. Hendley	Ditto ,,	Ditto ,,	Durga Pershad, Observer	Ditto ,,	Ditto ,,	
					Gunga Ram, Assistant Observer	Ditto ,,	Ditto ,,	
					Nathu Narain, ditto	Ditto ,,	Ditto ,,	
Chakráta	Third ...	Major Crichton, R.E.	Ditto ,,	30th Nov. 1881	Saligram[1]	Ditto ,,	Ditto ,,	
		P. Mackenzie, Esq., C.E.	1st Dec. ,,	31st Dec. ,,				
		Captain A. E. Ward, B.S.C.	1st Jan. 1882	31st Mar. 1882				
Ránikhet	Ditto ...	No Superintendent	......	......	Jewa Nand[1]	Ditto ,,	5th Sep. 1881	
					Gunga Dutt	6th Sep. ,,	15th Oct. ,,	
					Jewa Nand	16th Oct. ,,	31st Mar. 1882	
Dehra	Ditto ...	J. B. N. Hennessy, Esq.	1st April 1881	31st Mar. ,,	The head Computers	1st April ,,	Ditto ,,	
Meerut	Ditto ...	Dr. W. P. Harris	Ditto ,,	14th July 1881	Harsaran Das	Ditto ,,	Ditto ,,	
		Dr. W. M. Courtney	15th July ,,	14th Oct. ,,				
		Dr. W. P. Harris	15th Oct. ,,	31st Mar. 1882				
Bareilly	Ditto ...	P. Kennedy, Esq.	1st April ,,	9th May 1881	Jwala Parshad	Ditto ,,	Ditto ,,	
		E. A. Phillips, Esq.	10th May ,,	31st Mar. 1882				
Gorakhpur	Ditto ...	Dr. C. Prentis	1st April ,,	10th April 1881	Sheo Lochun	Ditto ,,	22nd Aug. 1881	
		Dr. A. E. R. Stephens	11th April ,,	8th July ,,	Nizam-ud-din	23rd Aug. ,,	31st Mar. 1882	
		Dr. C. Prentis	9th July ,,	31st Mar. 1882				
Benares	Ditto ...	Dr. G. Thibaut	1st April ,,	Ditto ,,	Devakinandan Pathak[1]	1st April ,,	Ditto ,,	
Gházipur	Ditto ...	Dr. P. A. Weir	1st Jan. 1882	......	No observer			
Sutna	Ditto ...	Dr. S. J. Goldsmith	Ditto ,,	Ditto ,,	Harnath[1]	Ditto ,,	26th Feb. ,,	
					Ram Sahai	27th Feb. 1882	4th Mar. ,,	
					Harnath	5th Mar. ,,	31st Mar. ,,	
Nowgong	Ditto ...	J. Mather, Esq.	Ditto ,,	31st Mar. ,,	J. Mather, Esq.	1st April 1881	31st July 1881	
					Karim Bakhsh	1st Aug. ,,	31st Mar. 1882	
Jhánsi	Ditto ...	Surgeon G. M. Nixon	Ditto ,,	16th Dec. 1881	Kalkadas	1st April ,,	Ditto ,,	
		Surgeon-Major F. A. Smyth	17th Dec. 1881	23rd Mar. 1882				
		Surgeon G. M. Nixon	24th Mar. 1882	31st Mar. ,,				
Sambhar	Ditto ...	W. Foster, Esq.	1st April 1881	Ditto ,,	Mr. John Romare	Ditto ,,	Ditto ,,	
Ajmere	Ditto ...	Dr. J. H. Newman	Ditto ,,	Ditto ,,	Rampershad	Ditto ,,	Ditto ,,	
Pauri	Ditto ...	Revd. J. T. McMahon	June ,,	Ditto ,,	No observer	......	......	
Pithoragarh	Ditto ...	Revd. Dr. Gray	May ,,	Ditto ,,	Ditto	......	......	

---

[1] Admitted to the higher allowances sanctioned from April 1882.

APPENDIX B III.

Statement showing the Expenditure of the North-Western Provinces' Meteorological Department for the year 1881-82.

	IMPERIAL SERVICES.				PROVINCIAL SERVICES.			REMARKS.
	Establishment.	Contingencies.	Reporters' travelling allowance.	Total.	Establishment.	Buildings, &c.	Total.	
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	
Meteorological Reporter	3,000 0 0	...	551 11 0	3,551 11 0	...	...	...	
Ditto Office	2,520 0 0	*980 1 0	...	3,500 1 0	...	†66 11 0	66 11 0	
Allahabad Observatory	600 0 0	...	...	600 0 0	...	500 0 0	500 0 0	Rs. 500 sanctioned by the Local Government for the erection of a new shed at the Muir College.
Agra ditto	840 0 0	25 0 0	...	865 0 0	...	...	...	
Roorkee ditto	840 0 0	16 2 0	...	856 2 0	...	...	...	
Lucknow ditto	900 0 0	22 12 0	...	922 12 0	...	‡180 11 8	180 11 8	
Chakráta ditto	180 0 0	31 15 4	...	211 15 4	...	...	...	
Ránikhet ditto	180 0 0	...	...	180 0 0	...	...	...	
Bareilly ditto	180 0 0	14 12 0	...	194 12 0	...	...	...	
Gorakhpur ditto	180 0 0	2 8 0	...	182 8 0	...	...	...	
Benares ditto	180 0 0	29 15 9	...	209 15 9	...	...	...	
Jhánsi ditto	180 0 0	40 3 0	...	220 3 0	...	...	...	
TOTAL	9,780 0 0	1,163 5 1	551 11 0	11,495 0 1	...	747 6 8	747 6 8	

* Including office-rent and general contingencies of the Meteorological Office and Allahabad Observatory.

† For completing the observatory-shed at Pauri.

‡ For removing the anemograph to a better position.

APPENDIX B IV.

Results of Ground Temperature Observations at Allahabad.

MONTH.	SURFACE.				ONE FOOT DEEP.				THREE FEET DEEP.				MEAN TEMPERATURE.			
	4 hours.	10 hours.	16 hours.	22 hours.	4 hours.	10 hours.	16 hours.	22 hours.	4 hours.	10 hours.	16 hours.	22 hours.	Air in shade.	Ground surface.	One foot deep.	Three feet deep.
April 1881	77·5	109·7	110·9	86·3	89·3	88·4	90·6	92·0	84·6	84·8	85·0	85·0	88·4	96·1	90·1	84·8
May ,,	83·0	112·4	112·5	90·6	95·8	95·0	96·7	97·6	90·8	90·9	91·1	91·0	91·8	99·6	96·3	90·9
June ,,	85·0	99·1	99·8	89·0	93·3	92·3	94·1	94·6	91·9	91·9	92·0	92·0	89·1	90·7	93·6	92·0
July ,,	82·3	90·1	90·0	85·0	87·3	87·0	87·8	88·3	88·2	88·5	88·6	88·5	84·3	86·8	87·6	88·4
August ,,	82·8	87·8	90·4	84·9	86·9	86·5	86·9	87·7	87·1	87·2	87·2	87·2	82·2	86·5	87·0	87·2
September ,,	81·8	89·8	92·0	84·7	86·9	86·5	87·7	87·9	87·3	87·4	87·4	87·3	83·1	87·1	87·2	87·4
October ,,	72·1	87·6	88·9	76·3	80·9	80·6	82·0	82·1	84·7	84·7	84·7	84·6	77·0	81·2	81·4	84·7
November ,,	57·7	75·0	79·2	62·7	70·2	70·0	71·4	71·6	77·6	77·6	77·7	77·6	65·1	68·6	70·8	77·6
December ,,	51·7	67·9	74·6	57·0	65·0	64·2	65·4	66·2	72·3	72·3	72·4	72·3	59·3	62·8	65·2	72·3
January 1882	52·1	68·3	76·2	58·2	64·9	64·2	64·7	63·2	70·3	70·3	70·4	70·4	60·4	63·7	64·2	70·4
February ,,	56·0	74·3	80·9	62·3	68·5	67·5	68·7	70·0	71·8	71·9	72·0	71·9	64·1	68·4	68·7	71·9
March ,,	67·5	89·1	94·6	76·1	78·6	77·8	78·7	80·2	77·0	77·2	77·3	77·3	79·6	81·8	78·8	77·2

APPENDIX B V.

Results of Ground Temperature Observations at Jeypur.

MONTH.	SURFACE.				FOUR INCHES DEEP.				ONE FOOT DEEP.				THREE FEET DEEP.			
	4 hours.	10 hours.	16 hours.	22 hours.	4 hours.	10 hours.	16 hours.	22 hours.	4 hours.	10 hours.	16 hours.	22 hours.	4 hours.	10 hours.	16 hours.	22 hours.
August 1881	80·2	80·6	86·5	81·7	79·9	80·7	85·5	83·3	82·7	81·7	84·1	84·6	83·6	83·7	83·7	83·6
September ,,	Untrustworthy.				82·5	82·5	89·5	86·6	84·8	83·4	86·9	87·7	84·9	85·0	85·0	85·0
October ,,	Ditto.				79·9	80·0	90·0	84·7	82·7	81·0	85·1	85·5	84·9	84·9	85·0	84·9
November ,,	55·9	75·9	84·7	82·8	65·3	66·0	77·5	70·9	70·0	68·7	72·1	73·2	77·0	73·9	77·3	77·1
December ,,	52·0	68·5	74·4	57·3	59·4	60·0	69·6	63·8	61·3	61·9	64·7	65·5	69·9	69·9	70·1	70·0
January 1882	48·3	70·9	72·0	53·3	56·3	59·6	71·3	61·6	61·4	59·7	63·3	64·4	65·4	65·4	65·5	65·6
February ,,	49·7	80·3	90·4	55·2	58·6	63·2	82·8	66·1	64·2	62·2	66·7	68·2	66·6	66·9	66·9	66·9
March ,,	57·9	100·9	109·2	65·1	69·8	78·0	96·4	78·6	75·1	73·6	77·8	79·4	73·2	73·3	73·5	73·4

Results of Ground Temperature Observations at Jeypur—(concluded.)

MONTH.	TEN FEET DEEP.				TWENTY FEET DEEP.				MEAN TEMPERATURE.						
	4 hours.	10 hours.	16 hours.	22 hours.	4 hours.	10 hours.	16 hours.	22 hours.	Air in shade.	Ground surface.	Four inches deep.	One foot deep.	Three feet deep.	Ten feet deep.	Twenty feet deep.
August 1881	83·3	83·4	83·3	83·6	...	...	...	...	80·4	82·2	82·4	83·3	83·6	83·4	...
September ,,	83·3	83·3	83·3	83·3	...	...	...	...	81·2	?	85·3	85·7	85·0	83·3	...
October ,,	83·9	83·5	83·8	83·8	...	...	...	...	78·8	?	83·6	83·6	84·9	83·8	...
November ,,	82·6	82·6	82·6	82·6	...	...	...	...	66·1	74·8	69·9	71·0	76·3	82·6	...
December ,,	78·9	79·3	79·2	79·2	...	...	...	...	62·1	63·0	63·2	63·2	70·0	79·2	...
January 1882	73·7	73·7	73·7	73·6	79·7	79·7	79·8	79·7	60·3	61·1	62·2	62·2	65·4	73·7	79·7
February ,,	72·9	72·9	72·8	72·8	79·0	78·9	78·9	78·9	62·4	68·9	67·7	65·3	66·8	72·8	78·9
March ,,	72·9	72·9	72·9	72·9	78·1	78·1	78·1	78·1	76·2	83·3	80·7	76·5	73·4	72·9	78·1

APPENDIX C.

Administration Report of the Meteorological Reporter to the Panjab Government for 1881-82.

There has been no change in the method of taking observations during 1881-82, and the number of observatories in the Panjab has remained unaltered.

All the observatories and observers were fully supplied during the year with clocks and watches, so that there was no excuse for mistakes or neglect in observing punctuality in the time of registering observations.

File and copy-books were issued to all the observatories during 1881-82, as considerable inconvenience had been experienced in previous years, owing to the observers being frequently changed, in the preservation of official records.

2. Besides the routine work of my office, monthly Meteorological abstracts have been sent to the Sanitary Commissioner, as well as a Meteorological report to the Panjab Government. Several statements were from time to time supplied to local officers, and the observations taken at Lahore were published every day in the *Civil and Military Gazette.* The whole of the work has been satisfactorily performed by my clerks, who are also the observers of the Lahore observatory.

3. The status of the observatories remains the same as last year. Ten are third-class, and one, the Lahore observatory, is second-class. Lahore ought undoubtedly to be a first-class observatory. The position of the present observatory is very faulty, but it is hoped that a better site will be secured for it when the new medical school buildings are completed.

4. It is much to be regretted that it has not yet been thought advisable to furnish the Lahore observatory with Van Rysselberghe's Meteorograph. This instrument, which was specially sent out from home for this observatory two years ago, would probably be of great service in a station like Lahore; but it has not yet been supplied to the observatory, because the Government of India is doubtful if any one on the spot has sufficient practical acquaintance with the management of delicate mechanisms and electric batteries. I am confident, however, that this is not a difficulty which should necessitate the postponement of the question for future consideration, and, under any circumstances, it appears to me that the instruments would suffer less by being brought into use here, than by being kept in store in Calcutta.

5. During August and September 1881 I inspected all the observatories in the Province, except Dera Ismail Khan and Mooltan. I had intended to visit these in the cold weather, but as they were inspected by Mr. Eliot in November, any further inspection by me so late in the year did not seem necessary.

6. At Rawalpindi I found the shed built well, and according to pattern, and in very good order. The instruments were neither well kept nor clean. The wind-vane stand was not firm, and the observer was directed to have it made so. The observer at this station gave much trouble during the year and neglected to maintain accuracy in his observations.

7. The observatory at Murree was found, as it invariably is, in capital order, and all the records and observations kept with great care and neatness. It is always a pleasure to visit this observatory. Its condition reflects the greatest credit on Mr. Cruickshank and his predecessor Mr. Johnson; though, without disparagement to these gentlemen, I am convinced that it is to a great extent due to the constant interest in it displayed by the Principal of the Lawrence Memorial Asylum, who is the Honorary Superintendent.

8. The observatory at Sialkot is under the charge of Assistant-Surgeon Fatteh Singh, who has the reputation of being a careful and trustworthy observer. The shed is in a faulty position, and the rain-gauge was too close to it. The instruments were in good order and clean at the time of my visit. The wind-vane was not fixed, and the ladder, which leads to the roof on which it is placed, was in a most unsafe condition. I ordered this to be replaced by a staircase and rail. This ought to have been done long ago, as it appears to me totally impossible that the Assistant-Surgeon, who is the observer n charge, could have gone through the break-neck performance, of climbing on to the roof twice a day, by the ladder in the condition I found it: and it is quite obvious that if he did not, the observations reported have been worthless.

9. At Peshawar, I found the records kept very neatly. The observer has given satisfaction during the year, by the accuracy of his observations. I found the shed small, and not made according to pattern. The barometer was an old one and kept in the verandah. The rain-gauge was at the Jail, a long way off the observatory. The instrument-cage was too high. A new barometer was supplied, and all the defects above noticed remedied, except that a new shed has not hitherto been put up, as the estimate for it was so high, *viz.*, Rs. 500, that it was out of the question. It is

expected that a very much less cost will suffice for its erection, and Dr. Coates, the Civil Surgeon, is at present engaged in an endeavour to arrange for it.

10. At Ludhiana I found all the records and instruments-shed, &c, in good order. The Assistant-Surgeon is well known to me as a man of intelligence, but I had to find fault with him, with regard to the time of registering observations.

The observatory clock was not going when I made my visit, and had not been for some time, and the observer was unable to afford any explanation of the way in which he observed punctuality in its absence.

11. At Delhi, I found that the shed was at least a foot too low. The stand of the anemometer was unfixed. With the exception of these and a few other trifling defects, which were remedied during my visit, I found everything in the observatory in fair order, and the records well kept.

12. At Sirsa, I found all the instruments, except the rain-gauge, in good order. The anemometer was in the wrong position on the roof of the shed, and I ordered it to be removed to the top of the Jail Office. The rain-gauge was out of order, and was replaced by a new one, and a number of petty repairs were effected during my inspection visit. The shed itself was in a most tumbledown condition, and was condemned, and has since been re-constructed on a new and better site selected by Mr. Eliot.

13. Simla was the last observatory inspected. The instruments were found well kept, clean and in good order. The observer had only recently been appointed, and was not aware of the proper method of setting the instruments. He was also not clear about the time of registering observations.

All this was fully explained to him, and his work since has been good and trustworthy.

14. From the above brief report of my inspection of the observatories in the Punjab, it is apparent that, at the time of my visit, the instruments and appliances were generally in fair order. I doubt, however, whether it is safe to infer from appearances at an inspection visit, that the work of the observatories is carried on in a manner to make the observations recorded really trustworthy as a basis for deductions.

At my visit, I noticed many little points, in several of the observatories, which were in themselves trifling, but which raised a doubt in my mind as to the trustworthiness of the work performed by the observers in charge. For instance, in one or two, the wind-vane was not fixed; in many others, the pad for the grass-thermometer was out of repair; and, in more than one, the means of getting at such of the instruments as were placed on the roofs of buildings, consisted of nothing more than a rotten ladder, which was in much too dangerous a condition to admit of its being used for the purpose for which it was intended. Moreover, I found, on careful enquiry, that carelessness about time was very common at many of the stations, and that the loosest ideas prevailed generally about the importance of punctuality in registering observations.

At one station on the line of railway, the observer had the audacity to inform me that he was in the habit of setting his clock, which was not going when I visited the observatory, by the whistle of the engine, which comes in daily with the half-past 2 train from Lahore.

Finally, I have been informed that it is not uncommon for the observers who draw the pay, 15 rupees a month, of the appointment, to hand over to one of their subordinates in the dispensary, or even to one of the servants, 2 or 3 rupees a month to take observations for them.

The reason of all this appears to me to be that, though lots of money is spent on it, the Meteorological Department is practically starved. The Superintendents of the observatories are hard-worked Civil Surgeons, who get no extra pay for the appointment, and who are frequently changed. At Delhi, for example, the Superintendent was changed four times during 1881; and at Sialkot and Dera Ismail Khan, no less than six times. On the other hand, the observers are usually Assistant-Surgeons or Native Doctors who have their official work and private practice to look after. It is a very great tie, indeed, to have to register observations at two fixed times every day, all the year round; and it is too much to expect men of this class to do this and the other work of the observatories for 15 rupees a month.

In my opinion, 50 rupees a month would not be more than enough to ensure carefulness, and create an interest in Meteorology on the part of men of the Assistant-Surgeon class; and if this sum cannot be granted, it would be much better to train an inferior class of men to perform the Meteorological work.

Many such men are to be found about every dispensary, in the compound of which the observatory is generally situated, such as the clerk or compounder, who are constantly on the spot, and to whom an addition of 15 rupees a month salary would be a real gain and sufficient to ensure punctuality and all the other essentials required in an observer, by the head of the Meteorological Department.

15. Mr. Eliot, Officiating Meteorological Reporter to Government of India, inspected the Panjab observatories in December 1881, and his reports were, in every instance, extremely satisfactory.

A list of Superintendents and Observers in charge of the observatories is appended, as well as a list, showing the breakages of instruments which occurred during the year.

ED. LAWRIE, M.B.,
Meteorological Reporter for Panjab.

LAHORE;
The 23rd May 1882.

APPENDIX C I.

List showing the Names of the Superintendents and Observers at the Meteorological Observatories in the Province of the Panjab during the year 1881-82.

Observatories.	Class.	Names of Superintendents.	Period.		Observers.	Period.		Allowance.	Meritorious allowance intended for 1882-83.
			From	To		From	To		
LAHORE	II	Dr. Ed. Lawrie, M.B., Meteorological Reporter to Government, Panjab	Throughout.		Babu Jasput Rai, Head Clerk, Meteorological Office Babu Divan Chand, 2nd Clerk, Meteorological Office	Throughout.		20 10	... ...
DELHI	III	Surgeon-Major A. Taylor ,, ,, R. E. Wrafter Dr. J. Ferguson Surgeon-Major G. Ross	1st April 20th Oct. 26th Oct. 3rd Nov.	19th Oct. 25th Oct. 2nd Nov. 31st Mar.	Asst.-Surgeon. Ram Kishen ,, ,, Radha Kishen	1st April 29th Dec.	28th Dec. 31st Mar.	15	...
LUDHIANA	III	R. Rouse, Civil Surgeon	Throughout.		Asst.-Surgeon Bhugwan Dass	Throughout		15	...
MULTAN	III	R. Gray, ditto	Ditto.		Babu Wahid Ally Shah	Ditto		15	5
DERA ISMAIL KHAN	III	Dr. R. J. Taaffe ,, H. Haig ,, G. B. Davis ,, P. Haig ,, G. B. Davis ,, R. J. Taaffe	1st April 9th ,, 2nd June 17th ,, 15th Sep. 13th Dec.	8th April 1st June 16th ,, 14th Sep. 12th Dec. 31st Mar.	Hospital Assistant Noor Bukhsh ,, ,, Sher Baz ,, ,, Noor Bukhsh	1st April 1st Nov. 1st Dec.	31st Oct. 30th Nov. 31st Mar.	15 ...	... ...
SIRSA	III	Asst.-Surgeon Fatteh Singh Dr. R. Crossby, C.S.	1st April 14th ,,	13th April 31st Mar.	Hospital Assistant Fuzalr Rahman	Throughout		15	5
SIALKOT	III	,, A. M. Crafts ,, G. V. Currie Asst.-Surgeon Fatteh Singh Dr. A. M. Crafts Asst.-Surgeon. Fatteh Singh Dr. Thomas S. Veale	1st April 23rd July 5th Sep. 19th ,, 28th ,, 18th Nov.	22nd July 4th Sep. 18th ,, 27th ,, 17th Nov. 31st March	Babu Surdar Khan, Dispensary Clerk Asst.-Surgeon Fatteh Singh	1st April 1st May	30th April 31st Mar.	15	...
MURREE	III	R. E. Peak, Principal, L.A.	Throughout.		R. Johnson Mr. Cruickshank	1st April 18th Oct.	17th Oct. 31st Mar.	15	...
SIMLA	III	Quarter Master General	Ditto.		C. M. Peart	Throughout		15	...
PESHAWAR	III	Surgeon T. E. L. Bate ,, K. M. Dowine ,, T. E. L. Bate ,, W. Coates, M.D. ,, T. E. L. Bate	1st April 21st Aug. 1st Oct. 13th Nov. 22nd Dec.	20th Aug. 30th Sep. 12th Nov. 21st Dec. 31st Mar.	Hospital Assistant Kashi Ram	Throughout		15	5
LEH	II	N. Elias, Joint-Commissioner	Throughout.		Hospital Assistant Sarfiraz Khan Hera Lal, Assistant-Surgeon Bhola Nath, Assistant Observer	1st April 1st Dec. Throughout	30th Nov. 31st Mar.	20 15	... ...
RAWAL PINDI	III	......	......		Bhawani Dass, Asst.-Surgeon Jaggan Nath, ditto	1st April 25th Jan.	24th Jan. 31st Mar.	15	...

LAHORE;
The 23rd May 1882.

ED. LAWRIE, M.B.,
Meteorological Reporter for Panjab.

APPENDIX D.

Report on the working of the Observatories in the Central Provinces during the year 1881-82.

During the year 1881-82 there were no changes in the number or class of observatories in the Central Provinces.

SECOND-CLASS OBSERVATORIES.

Nagpur.—This is the only one which I have had an opportunity of visiting. I arrived at the observatory, unexpectedly, about 6 A.M., and found only the Assistant present. He had just noted the reading of the grass radiation thermometer. I found the wire-fence round the enclosure broken, and in the state, in which, it then was, cattle could easily make their way into it at several points. The Superintendent afterwards informed me that the fence was in good order a couple of days before my visit.

The thermometer-shed, built on the usual plan, was in good repair, and the thermometers clean, properly hung, and in order; and the directions laid down for changing the muslin and wick attached to the wet bulb thermometer carefully carried out. A small tumbler is used as a receptacle for the water, instead of a narrow-necked bottle. Rain-water is exclusively used. The Assistant was putting out the solar radiation thermometer at the time of my visit, under the impression that exposure from sun-rise to sun-set was necessary. On examination, I found a small portion of the mercurial column, about a degree, detached at the upper end of the tube. I am not aware whether allowance is made for this or not, but have addressed the Superintendent on the subject.*

The barometer was properly hung and in working order. An anemograph-tower has been constructed by the Public Works Department, at a cost of Rs. 639-3. It has, however, been erected within about 10 feet of the pukha masonry platform, on which the wind-vane and anemometer are placed, and overtopping them to a considerable height, and, I should say, rendering the observations of these comparatively valueless. I have been unable to ascertain who is answerable for this. There is a clock in the office, which I found, at the time of my visit, was accurately kept to local time. The chief defect in the arrangements at this observatory is, that the observer himself is non-resident, and seldom arrives before 10 A.M. This, however, is, under existing circumstances, unavoidable, there being no sort of accommodation nearer than Nagpur, which is about 2 miles distant.

Jubbulpore.—From Jubbulpore the Superintendent reports that "the barometer was removed from its old site in the Central Jail to the office room of the new Civil Branch Dispensary; the index point in the latter station is 10 feet 7 inches lower than before; its present level, therefore, 1340·75 above mean sea-level, and the first reading was made at 10 hours of 8th April 1881."

The Superintendent states that the thermometer-shed requires extensive repairs, none having been executed since 1879. The anemometer and wind-vane require to be raised 15 feet, as some trees in the neighbourhood are beginning to influence the westerly and north-westerly winds, though so far, only slightly; on the trees increasing in size, the effects will become more and more decided.

Pachmarhi.—At Pachmarhi the position of the barometer was changed from 12th March 1882, the observatory building being under re-construction.

THIRD-CLASS OBSERVATORIES.

Chanda.—The barometer was removed temporarily, in December last, to another room, whilst the one in which it was permanently kept was under repair. The grass radiation thermometer was broken during a violent storm.

Saugor.—A post for the wind-vane and anemometer was erected at a cost of Rs. 261. No other alterations took place.

Hoshangabad.—The barometer was put out of use temporarily, on 27th March 1882.

---

* I have since ascertained that no allowance has hitherto been made for this, in recording the observations.

B. S.

Khandwa.—A wet minimum thermometer was received on the 20th July 1881, supplied from the Sanitary Commissioner's office store.

Seoni.—The rails round the thermometer-shed were repaired; a new anemometer, No. 518, brought into use on 3rd June, and a wet minimum thermometer supplied from the Sanitary Commissioner's office store on the 29th November 1881, to replace No. 3495, which the Superintendent reports was broken in the process of cleaning, by the Assistant. He remarks that "these thermometers are very liable to be broken at his observatory, owing to the frequent necessity to clean the bulb from the lime so abundantly deposited from the water." This appears to me to be a most unsatisfactory explanation. There can be no excuse for not using rain water; neither the Superintendent nor observer seem to have studied the simple directions laid down in the Manual.

Raipur.—With the exception of re-roofing the thermometer-shed, and slightly raising the eaves, no alterations appear to have been made in the building.

Grass radiation thermometer No. 38447, and barometer 8-1878, by Adie, were both broken during the year, and new instruments, in consequence, substituted. No satisfactory account has been given by the Superintendent as to the cause of the breakage. In the case of the thermometer, he says its appearance indicated that it was broken by a stone; but neither he nor the observer seem to be able to state whether any stone was noticed near it; the enquiry does not seem to have been a very searching one.

Sambulpur.—The present shed has been in use since 1879. With the exception of a masonry, building. pillar for a sun-dial, and the usual annual repairs, no alterations are reported in the observatory

A compass, No. C-69 and sun-dial, No. S-62, were supplied during the year.

The Superintendent reports that the present meteorological shed, which is situated in an open space, 66 yards distant from the Jail wall, will have to be removed, as the Jail is to be enlarged, the extension coming up close to it, will seriously affect the observations.

Sironcha.—No alterations were made to the buildings during the year.

CONDUCT AND QUALIFICATIONS OF OBSERVERS.

The Superintendents of the Hoshangabad and Chanda Observatories have sent in no report under this head.

The Superintendent of the Jubbulpore Observatory has reported, in very unsatisfactory terms regarding two of his observers. One resigned on 28th February last, on hearing that it was intended to remove him. He was relieved by Babu Banikanta Roy Chowdry, transferred from the Meteorological Office, Bengal. This man has worked most unsatisfactorily, exhibiting great want of energy and punctuality in the performance of his work. He has pleaded illness as the cause, but the Civil Surgeon is unable to confirm his statement.

The Superintendent of the Saugor Observatory reported, on the 7th of April last, in answer to enquiries from this office, that both the conduct and qualifications of his observer were "very good." The words are in the Superintendent's own handwriting. I am at a loss to understand why Dr. Strong should have recorded such remarks, after the receipt of letter No. 500, dated 18th March 1882, from the Meteorological Reporter to the Government of India, a copy of which was forwarded to him in due course, and in which the Reporter ordered the immediate dismissal of the Observer, as being utterly untrustworthy.

As I have only been in charge of this office since the 3rd of April last, I regret I am unable to offer any remarks from personal knowledge, or observation, on the working of any of the observatories in these Provinces, with the exception of Nagpur. I regret this the more, as my predecessor has left no notes of his inspections to guide me in drawing up a report on the subject. Such particulars as are given are gleaned from letters received from the Superintendents of the several observatories.

The usual statements will be found annexed.

B. SIMPSON, M.D.,
Deputy Surgeon General and Sanitary Commr.,
Central Provinces.

NAGPUR;
The 27th May 1882.

APPENDIX D I.

Names of the Superintendents and of the Observers at the Meteorological Observatories in the Central Provinces during the year 1881-82.

Observatory.	Class.	Officer in charge.	Date. From.	Date. To	Observer.	Date. From.	Date. To.	Remarks.
Nagpur	2nd Class	Surgeon H. M. Leckler Major H. A. Hammond Surgeon-Major R. T. Wright, M.D. F. C. Berry, Esq. Surgeon-Major R. T. Wright, M.D.	1st April 1881 6th June ,, 22nd Nov. ,, 29th Jan. 1882 8th Feb. ,,	5th June 1881 21st Nov. ,, 28th Jan. 1882 7th Feb. ,, 31st March ,,	*Observer.* T. V. Allagherri Swamy *Assistant Observer.* P. Soobiab	1st April 1881 1st April ,,	31st March 1882 31st March ,,	
Jubbulpore	Ditto	,, ,, W. R. Rice, M.D.	1st April 1881	31st March ,,	*Observer.* Prasanna Kumar Basu Banikanta Ray Chowdhury *Assistant Observer.* 2nd Class Hospital Assistant Koonja Behari Lall	1st April ,, 1st March ,, 1st April ,,	28th Feb. ,, 31st March ,, 31st March ,,	
Pachmarhi	Ditto	R. H. Finch, Esq.	1st April ,,	31st March ,,	*Observer.* Madho Rao *Assistant Observer.* Narain Bhagwant	1st April ,, 1st April ,,	31st March ,, 31st March ,,	
Saugor	3rd Class	Surgeon-Major J. W. Strong	1st April ,,	31st March ,,	*Observer.* Deendayal Pathuck	1st April ,,	31st March ,,	
Hoshangabad	Ditto	Surgeon S. H. Browne, M.D. ,, G. R. Daphtary, M.D. ,, S. H. Browne, M.D.	1st April ,, 27th April ,, 27th July ,,	26th April 1881 26th July ,, 31st March 1882	Jadu Nath Bose	1st April ,,	31st March ,,	
Khandwa	Ditto	Surgeon-Major P. Cullen, M.D.	1st April ,,	31st March ,,	Biharilal Parasar	1st April ,,	31st March ,,	
Seoni	Ditto	,, ,, J. B. Gaffney	1st April ,,	31st March ,,	Punchum	1st April ,,	31st March ,,	
Chanda	Ditto	Assistant-Surgeon Umesh Chandra Mitter, M.B. Mr. M. Craggs Assistant-Surgeon Umesh Chandra Mitter, M.B. Surgeon H. Armstrong	1st April ,, 6th May ,, 13th Oct. ,, 30th Dec. ,,	5th May 1881 12th Oct. ,, 29th Dec. ,, 31st March 1882	Seeta Ram	1st Aprii ,,	31st March ,,	
Sironcha	Ditto	Assistant-Surgeon Harran Chandra Dutt	1st April ,,	31st March ,,	1st Class Hospital Assistant P. Moothoo Krishna Naidoo Assistant-Surgeon Harran Chander Dutt	1st April ,, 18th Jan. 1882	17th Jan. ,, 51st March ,,	
Raipur	Ditto	Surgeon-Major D. W. Trimnell	1st April ,,	31st March ,,	Krishna Rao	1st April 1881	31st March ,,	
Sambalpur	Ditto	Honorary Surgeon G. E. Harrison	1st April ,,	31st March ,,	Shamsoonder Dass	1st April ,,	31st March ,,	

APPENDIX E.

Extracts from a Report on the Administration of the Meteorological Department of Western India for the year 1881-82.

* * * * * * * * * *

STORM-WARNING SERVICE.

2. This service has been carried on on the same footing as in the previous year. Regular daily telegraphic reports were received from all the following stations, except Calicut, which sends no reports on Sundays:—

Karachi.
Surat.
Ratnagiri.[1]
Karwar.
Mangalore.
Calicut.
Cochin.
Negapatam.
Madras.
Masulipatam.

The Colaba observatory, Bombay, also furnished regular daily reports. As soon as the Code Messages arrive, they are translated into their corresponding instrumental readings, which, after correction and reduction, are curved, charted, and entered in a tabular daily report, a copy of which is usually ready before 4 o'clock in the afternoon, except on Sundays, when the closing of many of the telegraph offices, at certain hours, delays the report till about 7 hours 30 minutes P.M. These reports are prepared merely for office use, and are not published, except in an indirect way; the Port Officer sending his messenger to the office daily for a copy of the report, and permitting the Editor of the *Times of India* to copy and publish it whenever he finds it convenient to do so. Extracts from the report are also given to the Editor of the *Bombay Gazette*, who sends a messenger to the office for the information, and occasionally publishes it in the paper. The full significance of the details entered in these reports can only be seen, even by a professional meteorologist, after the processes of curving and charting have been gone through. * * * * * *

* * * * * * * * * *

4. Four additional storm-signal stations have been established during the year, *viz.*, Goa, Daman, Bhavnagur Creek, and Bhavnagar Bandar. The complete list now includes sixteen stations, as shown below:—

Storm-Signal Stations.

Principal Stations.	*Subsidiary Stations.*
Karachi	......
Bhavnagar Bandar	Bhavnagar Creek.
Daman	......
Bombay Castle	Prince's Dock, Colaba Point, (*a*) Kenneri.
Ratnagiri	......
Vengurla	Vengurla Rocks, (*a*) Malvan.
Aguada Head, Goa	......
Karwar	Oyster Rock Light-house, Karwar.
Kumba	......

All the stations were furnished, in September and October last, with cones and lanterns, for making the signals, and placards, printed in large type describing the character and meaning of the signals, have been distributed to the various ports.

5. Telegraphic communication between the Meteorological Office and the Central Telegraph Office has not yet been established, but it is understood that the connection will shortly be made by the Telegraph Department. The contemplated revision of the Meteorological Telegraph Code also still remains to be carried out, and the grave defect referred to last year, *viz.*, the absence in the Code

---

[1] Reports commenced on the 27th May 1881.

of any provision for affording information as to the velocity of the wind at the time of observation is still seriously felt. Since the 1st of January 1882 the revised Telegraph Rules have permitted the transmission of eight words at the same cost as six, the number used in the Meteorological Code; but I have been prevented from utilising the two additional words, for the purpose of obtaining the telegraphic transmission of the wind velocity, by the consideration that confusion might thus be introduced into the general telegraphic work of the Indian Meteorological Department.[1] The total movement of the wind during the preceding twenty-four hours is given by the use of the present Code; but this intelligence is far less informing than the actual velocity of the wind at the hour of observation, and is, besides, at best, twelve hours older than most of the other information afforded by the daily telegrams.

6. The past year was an eventful one with regard to storms. Between May 27th and June 3rd, a most terrific cyclone crossed the Arabian Sea, from east to west, but in no part of its course was it sufficiently near the West Coast of India to produce violent winds on land, although a tremendous swell was felt at almost every reporting station along the coast. With the assistance of Captain Morland, Port Officer, Bombay, a great number of ships' logs have been collected from vessels that were either involved in, or were in the neighbourhood of this cyclone. In one of these logs is recorded a barometric reading of 27·3 inches, at which point the index was stopped by the thermometer attached to the instrument, so that even this low reading does not give the actual minimum pressure of the cyclone.

7. Another cyclone, accompanied by heavy rainfall, passed over Kathiawar and Cutch on the 12th and 13th July, causing great destruction of house property. It also raised the force of the monsoon wind, between Surat and Bombay, to a violent gale, wrecking a mail-boat in the Gulf of Cambay, and disabling the S. S. *Calder*, which had to put back to Bombay under the greatest difficulty, after having had some of the deck passengers washed overboard. No intimation of the existence of this cyclone reached the Meteorological Office, until after office hours, on the 12th. The regular daily telegrams of the 11th showed no indication of it, except that the barometer had fallen slightly at Surat; but as there was an error in the Surat telegram, even this slight indication could not be relied on. A repetition of the message was at once called for, and special reports were, at the same time, demanded from several other stations, including Rajkot, which, as afterwards appeared, was, on the 12th, near the centre of the disturbance; but no information reached the Office, in time, to permit of the announcement, in the reports of the 12th, of the fact that a cyclone was then passing over Kathiawar.

* * * * * * * * *

8. Another cyclonic disturbance occurred between the 11th and 17th November 1881. The centre of the barometric depression passed in a north-westerly direction, between Madras and Negapatam, over the Peninsula, to Goa, and onward over the Arabian Sea, to the west of Karachi. The first decided indications of this November storm were noticed in the daily telegraphic reports of the 12th, when special reports from additional stations were at once called for; but the additional information did not arrive in time to permit of warning-telegrams being issued to the Ports to the southward of Bombay, till the afternoon of the 13th, when the storm had already reached Goa. The fact that it had done so was not known at the Meteorological Office, however, till after office hours on the 13th, more than twenty-four hours having elapsed before the arrival of any of the special information called for on the afternoon of the 12th from Goa. The warning signals were hoisted at Bombay and Bhavnagar on the morning of the 14th November; but though the influence of the cyclone was decidedly noticeable in the veering of the wind, in the cloudy sky, and in other meteorological changes, the centre of the disturbance appears to have passed out to sea without coming sufficiently near to Bombay to cause the wind to blow with violence; and the signals were lowered on the following morning.

* * * * * * * * * *

10. Strong abnormal winds from south-south-east, of about 30 miles per hour, have been felt at Bombay, on several occasions, since the Storm-warning System was established, without any indications of rough weather having been observable in the barometric data furnished by the regular daily

---

[1] See text of the General Administration Report, page 44—H. F. B.

reports. The most remarkable of these disturbances occurred on the 22nd and 23rd October 1880, the 7th and 8th and the 29th and 30th of May 1881, and the 6th November 1881. On each of these occasions the abnormal wind blew for the whole of the day, with an average velocity of more than 20 miles per hour * * * * * *
These instances, and the cyclone of May 1879, make it seem probable that cyclones impinging against the Western Ghauts are much flattened and intensified on the side nearest the hills, and if this be so, it is easy to see that the barometric gradient between Bombay and Poona may undergo a sudden change of value, and perhaps of sign, at the line of the Ghauts, in which case, the difference between the sea-level values of the barometric pressure at Bombay and Poona will afford no measure of the magnitude of the gradient between Bombay and the foot of the Ghauts. The only way of meeting this difficulty, would be to arrange for barometric observations being taken at stations near the foot of the Ghauts, at Karjat and Vasind, for instance. The observations would have to be made with extreme accuracy, on account of the shortness of the direct distance between Bombay and those stations.

11. The following Statement shows the dates of all the special telegraphic weather reports received from those stations that send reports only when specially called upon to do so. It also shows the occasions when special cautionary or assuring telegrams were sent to the Port Officers of Bombay and Karachi; and also the stations to which warning telegrams, ordering the storm-warning signals to be hoisted, were issued during the year :—

Dates for which special observations were called for.	Dates when cautionary or assuring telegrams were issued to the Port Officers at		Stations to which telegraphic orders to hoist the storm signals were issued.	
	Bombay.	Karachi.	Station.	Date.
1881, May 11th to 15th	1881, May 12th	1881, May 31st	Ratnagiri	1881, November 13th
„ July 10th to 14th	„ July 3rd	......	Vengurla	
„ August 3rd to 7th	„ „ 6th	......	Goa	
„ November 11th to 17th	„ „ 13th	„ July 13th	Karwar	
1882, January 9th to 13th	„ November 8th	......	Kumba	
„ March 20th to 24th	„ „ 12th	.. ...	......	
	„ „ 13th	......	Bombay	„ „ 14th
	„ „ 14th	„ November 14th	Bhavnagar	
	„ „ 16th	„ „ 16th	......	

OBSERVATORIES.

12. The number of observatories remains the same as in the previous year, *i.e.*, twenty-three; none having been suppressed, and no new ones having been established during the year. The observatory at Zanzibar has, however, been raised from the voluntary to the permanent scale, and a paid observer, who commenced his duties on the 1st January 1882, has now been provided for it. From April to December 1881, the observations were taken very accurately and regularly by Dr. Robb, and the Department is much indebted to him for the interest he has taken in the work, and for the devotion with which he has personally maintained the continuity of the Meteorological record at that important station. A list of the observatories, showing the names of the Superintendents and of the observers who have held office during the year, forms Appendix I.

13. At several of the observatories there have been interruptions of the continuity of the registers, as indicated below, varying from one to four months, chiefly owing to sickness of the observers or to their absence on duty connected with their primary appointments in the Medical Department;

and it is not easy to see how these interruptions of the work can be prevented under existing circumstances:—

Interruptions in the registers.

Station.	From.	To.
Jacobabad	28th December 1881	3rd January 1882.
Bickaneer	17th January 1882	8th February 1882.
Hyderabad	1st April 1881	2nd May 1881.
Karachi	1st December 1881	2nd January 1882.
Mount Abu	16th June 1881	14th October 1881.
Mount Abu	8th February 1882	18th March 1882.
Rajkot	8th December 1881	5th February 1882.
Rajkot	22nd February 1882	31st March 1882.

The above list includes all the cases of total interruption of the records for more than a day or two, but does not include partial interruptions arising from derangements or breakages of instruments.

14. Three of the observatories, *viz.,* those at Deesa, Belgaum and Poona, are now furnished with self-recording anemometers, which are of the large Robinson-Beckley Pattern at the two former stations, and of the embossing pattern, by Casella, at the latter. The Deesa instrument has worked well throughout the year. Valuable traces have been obtained from that at Belgaum, from June 1881, and the instrument has been in perfect working order since October 1881. The Poona embossing instrument has given less satisfactory records on all days when there were no calms, but whenever calms occur the record is almost valueless. Arrangements are being made for the erection of another of these embossing instruments at Ratnageri in the hope that it may afford valuable information for the Storm-signal Service.

Inspection of Observatories.

15. No observatories have been inspected during the year, the working of the new Storm-signal Service having kept me in Bombay, and no arrangements having been made for carrying on this work during my absence on inspection duty.

Meteorological Erections.

16. No new erections have been constructed during the year, the only works executed having been of the nature of petty repairs to the thermometer-sheds, fences, &c.

Instruments and their verification.

17. The following table shows the number of instruments issued, and the observatories to which they were sent:—

[*The Return of the Instruments issued to Meteorological Observatories in 1881-82, which here follows, has been included in the General Return at page* 36 *of the General Report.*]

The above instruments were all verified at Bombay before being despatched to the respective stations. Of the five barometers, three were issued to supply the place of others that had become unserviceable by leakage, one in lieu of an instrument that required cleaning, and one as a duplicate, to test the accuracy of the instrument in regular use. Though less than in previous years, the destruction of grass-radiation thermometers has been very great, especially as compared with that of solar thermometers. Some of the former are said to have been broken by dogs or other animals, and the woollen pads on which the grass thermometers are exposed to have been torn to pieces; but more frequently the breakage report states that the instrument was found broken without any apparent cause, and it is clear that the grass thermometers are subject to sources of destruction which do not, to the same extent, affect the solar thermometers. One of these is doubtless the somewhat rough treatment required to re-unite the column of spirit whenever a portion becomes detached; but I do not think this cause can account for more than a very small number of the breakages. It is probable that many of these thermometers are burst by the heat of the sun, before being read and removed indoors at 10 o'clock in the morning, the hour fixed for taking the first set of observations.

TRAINING OF OBSERVERS.

18. The five observers named below have gone through a course of instruction at this office, and have obtained certificates of competency to perform the Meteorological work at second or third-class stations, as indicated. Passed Native Medical Pupil, Anaji Pandurang attended the office, at his own request, for about a fortnight, but failed to obtain a certificate of competency, for want of more time in which to qualify.

Observers trained in 1881-82.

Name.	Station.	Class.
Private Thomas Murphy	Poona	Second.
Hospital Sergeant Charles Barley	Mount Abu . . .	Third.
Private Frederick Bateman	Karachi . . .	Second.
Passed Native Medical Pupil, Shaik Adam	Zanzibar	Third.
Third-Class Hospital Assistant, Solomon Samuel . . .	Rajkot	Third.

Several other new observers have been taught at the observatories by their predecessors, but there is usually, in such cases, a marked difference, for the worse, in the capability of the new, as compared with that of the old observer; and the only thoroughly satisfactory arrangement is that each observer should undergo a preliminary course of instruction in Bombay. Unfortunately this is impracticable in many cases, under existing circumstances.

METHODS OF OBSERVATION AND REDUCTION.

19. No change has been made during the year in the methods of observation and reduction.

CHARACTER OF THE METEOROLOGICAL REGISTERS OF THE YEAR 1881.

20. In nearly all those cases in which the observers have held their appointments for a considerable time, or have had the advantage of going through a preliminary course of training at Bombay, the Meteorological registers have been carefully kept, and the observations throughout the year are accurate and trustworthy; but in the numerous instances in which it has been necessary to entrust the Meteorological work to new, untrained men, some of the more difficult observations have

usually been defective for a time. The general character of the work of the observers will be clearly seen from the following tabular statement :—

Defective Observations in the Registers of 1881.

Station.	Instrument.	Period.	Remarks.
Jacobabad . . .	*Nil*	*Nil*	All observations good.
Bickaneer . . .	*Nil*	*Nil*	Ditto
Hyderabad . . .	Maximum Thermometer .	May and June . .	Observer unable to manipulate the instrument.
Ditto	Anemometer . . .	April, May, and June .	New, untrained observer.
Ditto	Minimum Thermometer .	August 13th to December 12th . . .	Ditto.
Ditto	Wet Minimum Thermometer	Ditto	Ditto.
Karachi	*Nil*	*Nil*	All observations good.
Bhuj	Grass Thermometer .	?	Instrument out of order.
Deesa	*Nil*	*Nil*	All observations good.
Mount Abu . . .	Barometer . . .	April 26th to 29th . .	Observations appear to have been taken by an untrained person.
Ditto	Ditto	October 14th to the end of the year . . .	Observations appear untrustworthy; cause unknown.
Neemuch . . .	*Nil*	*Nil*	All observations good.
Indore	*Nil*	*Nil*	Ditto.
Rajkot	*Nil*	*Nil*	Ditto.
Surat	Anemometer . . .	July to October . .	New, untrained observer.
Akola	*Nil*	*Nil*	All observations good.
Amraoti	*Nil*	*Nil*	Ditto.
Chikalda	Grass Thermometer .	?	Instrument probably out of order.
Buldana	*Nil*	*Nil*	All observations good.
Malegaon . . .	Wet Bulb . . .	April 21st to May 11th .	Untrained observer.
Ditto	Barometer . . .	October 19th to 31st. .	New, untrained observer.
Poona	*Nil*	*Nil*	All observations good.
Sholapur	Barometer . . .	January	New, untrained observer.
Ratnagiri	*Nil*	*Nil*	All observations good.
Belgaum	*Nil*	*Nil*	Ditto.
Karwar	Wet Minimum Thermometer	July and part of August .	Index shaken out of position by strong wind.
Ditto	Ditto	Nov. 21st to December 1st	Instrument out of order.
Zanzibar	*Nil*	*Nil*	All observations good.

LIBRARY.

21. Appendix II[1] gives the list of books and pamphlets added to the Library during the past year. Almost all are works that have been presented to the office. The books have been carefully compared with the catalogue, and none are missing.

---

[1] This is not reproduced.—H. F. B.

OFFICE ESTABLISHMENT.

22. From the 3rd October to the 27th December 1881, I was absent on privilege leave, and during the interval, Surgeon Major W. Nolan, M. D., officiated as Meteorological Reporter for Western India. During the year, the office establishment stood as follows :—

Name.	Monthly pay at the end of the year.
FOR LAND METEOROLOGY.	Rs.
Ganesh Sadashio	51
Vajeram Iccharam	36
Mahadeo Ramchandra	36
Krishnaji Ramchandra	30
Ramchandra Sadashio	30
FOR THE STORM-WARNING SERVICE.	
Ramchandra Govind	30
Anant Vishvamber	30
MENIAL SERVICE	
Bhicu Sitaram	10

WORK OF THE OFFICE.

23. The work of the Office has been almost entirely confined to the regular routine work of correcting and reducing the Meteorological observations recorded at twenty-two observatories, to the verification of instruments and the training of observers, to the working of the Bombay Storm-Warning Service, and to the carrying on of the correspondence which these duties entail. A sketch of the Meteorology of the Bombay Presidency, in the previous year, was, as usual, prepared, for incorporation in the General Administration Report of the Bombay Government. In this sketch I showed how the barometric observations recorded at Zanzibar confirmed the conclusions previously arrived at by me, to the effect that barometric waves of long period travel slowly from west to east. I also showed that at Bombay there is a very decided relation between the daily abnormal height of the barometer and the daily rainfall—a high barometer corresponding to a light rainfall; a low one to a heavy fall. It is obvious, from this relation, that if the daily barometric movements could be foreseen, it would be possible to forecast the corresponding variations of the daily rainfall. Hitherto the only means of judging, on any day, of the probable character of the barometric movement on the following day has been to note the particular phase of the wave-like movement going on at the time, and, from that, to infer what would follow; but I have observed that, during the monsoon, these oscillatory movements of short period are not always simultaneous at all stations, but are often slightly earlier in phase on the Coromandel Coast and in Ceylon than along the West Coast of India; and this fact affords another means of judging from the telegraphic weather reports of the character of the coming barometric changes on the West Coast, and consequently of the coming rainfall.

24. I have not been able to make much further progress during the past year with my investigations into the nature of the so-called non-periodic variations of the barometric pressure. Beyond the extension of the reductions contained in my preliminary report on "Abnormal Variations of Barometric Pressure in the Tropics, and their relation to sun-spots, rainfall, and famines," so as to obtain values of the nine-monthly means of abnormal barometric pressure, corresponding to each month, and similar data for two or three additional stations, nothing has been done. I had hoped that any spare time the two tabulators employed to work the storm-signal service might have, after performing their primary duties, would have been available for this purpose; but I have received instructions to set aside my own investigations, and employ any spare time these youths may have,

upon the preparation of a report on past storms, and upon the collection of information, and the preparation of a special report on each of the storms that may occur in the future. Under these circumstances, and as my applications for special assistance have been unsuccessful, I have no hope of being able to continue my original researches, except by employing computers at my own private expense.

25. A list of the storms of the Arabian Sea, in past years, has been prepared, giving the dates of their occurrence, the localities affected, and other details. The distribution of the storms throughout the different months of the year, from January to December, is as follows: 4, 3, 2, 9, 13, 20, 2, 2, 3, 4, 10, 2, showing that storms are more frequent from April to June and in November than at other times of the year. The frequency of storms in different years, has a decided relation to the sun-spot cycle of about eleven years, being most frequent when the spots are most numerous, and least so when the spots are at a minimum, as will be seen from the following numbers, showing the distribution of the storms in the sun-spot cycle :—

Year.	Number of Storms.	Wolf's sun-spot numbers.
1860, &c.	8	72
1861, &c.	5	57
1862, &c.	8	50
1863, &c.	5	41
1684, &c.	6	26
1865, &c.	4	11
1866, &c.	4	8
1867, &c.	7	12
1868, &c.	7	27
1869, &c.	5	53
1870, &c.	8	74

26. As a necessary preliminary to the proper study of individual storms, comparable normal values of the monthly mean pressure and temperature, at all the observatories in Western and Southern India, are being prepared. These are being calculated from the observations of the five years 1877 to 1881, and they have already brought to light many discrepancies in the barometric records. Some of the barometers appear to have gradually fallen, more especially those unfurnished with air-traps, showing the absolute necessity of the air-trap as a means of preventing the deterioration of the mercurial barometer. Another remarkable discrepancy has been found in a persistent local depression of the barometer at Masulipatam, in the winter months of 1877-78. This must either be due to some defect of the instrument, or of the method of observation, or else to a peculiar persistent local barometric anomaly, like those to which Messrs. Blanford and Eliot have drawn attention in their reports; but I do not find any reference by them to this case, although it occurred in the famine year 1877-78.

27. Registers of daily rainfall at upwards of 400 stations in the Bombay Presidency, have, as in previous years, been collected, and are carefully recorded in the Office, for future reference. The duplicate set of observations taken at the old observatories at Belgaum, Poona and Deesa, during the twelve months preceding the final closing of these observatories, have been corrected and reduced, for comparison with simultaneous observations recorded at the new observatories.

F. CHAMBERS,
Meteorological Reporter for Western India.

METEOROLOGICAL OFFICE, BOMBAY;
Dated the 2nd June 1882.

APPENDIX E. I.

Names of the Superintendents and of the Observers at the Meteorological Observatories in Western India, during the year 1881-82.

Observatory.	Class.	Officer in charge.	Date.		Observer.	Date.		Remarks.
			From	To		From	To	
Karachi	Second	Surgeon-Major H. M. Macbeth	1st April 1881	11th Dec. 1881	Private R. Pope	1st April 1881	3rd Dec. 1881	
		Brigade-Surgeon J. L. Hinde	12th Dec. ,,	21st Mar. 1882	Private F. Bateman	2nd Jan. 1882	31st Mar. 1882	
		Surgeon-Major J. Paxton	22nd Mar. 1882	31st ,, ,,				
Deesa	Do.	Captain F. Forgett	1st April 1881	11th May 1881	Corporal W. Birch	1st April 1881	31st ,, ,,	
		Sugeon-Major C. MacDowall	12th May ,,	4th Dec. ,,				
		Surgeon G. A. Hughes	5th Dec. ,,	5th Feb. 1882				
		Surgeon-Major C. MacDowall	6th Feb. 1882	31st Mar. ,,				
Poona (Yerrawda)	Do.	Do. J. P. Greany	1st April 1881	31st ,, ,,	Sergeant T. W. Harriott	1st ,, ,,	25th Sept. 1881	
					Private T. Murphy	26th Sept. ,,	31st Mar. 1882	
Belgaum	Do.	Do. J. F. Brodie	1st ,, ,,	22nd Oct. 1881	Lance Corporal H. Farmer[1]	1st April ,,	31st ,, ,,	
		Brigade-Surgeon T. A. Lithgow	23rd Oct. ,,	31st Mar. 1882				
Jacobabad	Third	Surgeon E. Burroughs	1st April ,,	9th July 1881	Hari Bháu	1st ,, ,,	27th Jan. ,,	
		Do. G. E. Fooks	10th July ,,	21st Sept. ,,	Karim Raja Khan	28th Jan. 1882	3 st Mar. ,,	
		Do. Masavi	22nd Sept. ,,	29th ,, ,,				
		Do. E. Burroughs	30th ,, ,,	26th Dec. ,,				
		Do. M. L. Bartholomeusz	27th Dec. ,,	31st Mar. 1882				
Bickaneer	Do.	No Superintendent	......	......	Ram Lal[2]	1st April 1881	16th Jan. ,,	
					No observer	17th Jan. 1882	8th Feb. ,,	
					Ram Lal	9th Feb. ,,	31st Mar. ,,	
Hyderabad (Sind).	Third	No Superintendent	1st April 1881	2nd May 1881	No observer	1st April 1881	2nd May 1881	
		Surgeon-Major J. Williamson	3rd May ,,	11th Jan. 1882	Private J. Roper	3rd May ,,	12th Aug. ,,	
		Surgeon H. F. Dymmock	12th Jan. 1882	15th ,, ,,	Yousiff David	13th Aug. ,,	31st Mar. 1882	

		Surgeon-Major C. S. Close	16th ,, ,,	31st Mar. 1882			
Bhuj	Do.	Surgeon A. F. Sergent	1st April 1881	31st ,, ,,	Narayen Mâne[1]	1st April ,,	31st ,, ,,
Mount Abu	Do.	Surgeon-Major W. Watling	1st ,, ,,	27th Nov. 1881	Joseph Briggs	1st ,, ,,	15th June 1881
		Surgeon Hewett	28th Nov. ,,	27th Feb. 1882	No observer	16th June ,,	14th Oct. ,,
		Surgeon-Major W. Watling	28th Feb. 1882	31st Mar. ,,	Hospital Sergeant C. Barley	15th Oct. ,,	31st Mar. 1882
Neemuch	Do.	Assistant Apothecary A. X. Dias[3] Surgeon-Major R. Turner	1st April 1881	31st ,, ,,	T. Bachu[2]	1st April ,,	31st ,, ,,
Indore	Do.	Do. T. Beaumont	1st ,, ,,	11th June 1881	Gopal Rao	1st ,, ,,	16th Feb. ,,
		No Superintendent	12th June ,,	19th ,, ,,	Trimbukrao	17th Feb. 1882	31st Mar. ,,
		Surgeon-Major D. F. Keegan	20th ,, ,,	31st Mar. 1882			
Rajkot	Do.	Surgeon H. P. Jervis	1st April ,,	15th Dec. 1881	Shaik Dada Mya	1st April 1881	15th Dec. 1881
		Do. G. H. Bull	16th Dec. ,,	31st Mar. 1882	No observer	16th Dec. ,,	5th Feb. 1882
					Solomon Samuel	6th Feb. 1882	26th ,, ,,
					No observer	27th ,, ,,	31st Mar. 1882
Surat	Do.	Surgeon-Major T. B. W. Johnstone	1st April ,,	19th May 1881	Dhunji bhai Motabhai[2]	1st April 1881	31st ,, ,,
		Surgeon J. C. H. Peacocke	20th May ,,	11th June ,,			
		Do. R. Manser	12th June ,,	18th ,, ,,			
		Do. F. Jones	19th ,, ,,	31st Mar. 1882			
Akola	Do.	Apothecary D. Callaghan	1st April ,,	2nd June 1881	Samuel Gregory[2]	1st ,, ,,	31st ,, ,,
		Surgeon T. Hume	3rd June ,,	27th Aug. ,,			
		Do. J. J. Moran	28th Aug. ,,	31st Mar. 1882			
Amraoti	Do.	Apothecary G. E. King	1st April ,,	29th Aug. 1881	Bakaram Pandurang[2]	1st ,, ,,	22nd June 1881
		Surgeon T. Hume	30th Aug. ,,	31st Mar. 1882	Enoch Shadrach	23rd June 1881	28th ,, ,,
					Bakaram Pandurang	29th ,, ,,	13th Feb. 1882
					Enoch Shadrach	14th Feb. 1882	31st Mar. ,,
Chikalda	Do.	Do. C. L. Swaine	1st April ,,	16th July 1881	Aminulla Khan	1st April 1881	31st ,, ,,
		Apothecary W. E. Hendricks	17th July ,,	15th Sept. ,,			
		Surgeon C. L. Swaine	16th Sept. ,,	16th Dec. ,,			
		Apothecary W. E. Hendricks	17th Dec. ,,	19th ,, ,,			
		Surgeon C. Mallins	20th ,, ,,	31st Mar. 1882			

---

[1] These officers are to receive a special good service allowance of Rs. 10 per month from the 1st April 1882.

[2] Ditto ditto. Rs. 5 ditto.

[3] Alternately in periods of fifteen days to about a month each.

Names of the Superintendents and of the Observers at the Meteorological Observatories in Western India during the year 1881-82,—concld.

Observatory.	Class.	Officer in charge.	Date.		Observer.	Date.		Remarks.
			From	To		From	To	
Buldana	Third	Surgeon A. R. Menasse	1st April 1881	30th June 1881	Pandurang Krishnaji	1st April 1881	31st Mar. 1882	
		Do. D. Callaghan	1st July ,,	30th Sept. ,,				
		Do. A. R. Menasse	1st Oct. ,,	18th Nov. ,,				
		Do. D. Callaghan	19th Nov. ,,	31st Mar. 1882				
Malegaon	Do.	No Superintendent	1st April ,,	24th April 1881	Goolab Khan	1st ,, ,,	27th May 1881	
		Surgeon A. W. F. Street	25th ,, ,,	9th Nov. ,,	Keshav Govind	28th May ,,	5th June ,,	
		Brigade-Surgeon W. E. Cotes	10th Nov. ,,	17th Feb. 1882	Gopal Cuddum	6th June ,,	9th Nov. ,,	
		Surgeon W. A. Corkery	18th Feb. 1882	31st Mar. ,,	Anaji Pandurang	10th Nov. ,,	9th Jan. 1882	
					Gopal Cuddum	10th Jan. 1882	31st Mar. ,,	
Sholapur	Do.	Do. H. B. Briggs	1st April 1881	31st ,, ,,	Davidin	1st April 1881	4th May 1881	
					Shamji Gharoji	5th May ,,	8th June ,,	
					Keshav Govind	9th June ,,	31st Mar. 1882	
Ratnagiri	Do.	Do. H. McCalman	1st ,, ,,	16th ,, ,,	Mahadev Cuddum[1]	1st April ,,	31st ,, ,,	
		Surgeon-Major M. M. Mackenzie	17th Mar. 1882	31st ,, ,,				
Karwar	Voluntary	R. G. C. Westbrook, Esq., Port Officer	1st April 1881	31st ,, ,,	G. W. M. D'Araujo	1st ,, ,,	31st Jan. ,,	
					Damodher Vishnu	1st Feb. 1882	31st Mar. ,,	
Zanzibar	Do.	Surgeon-Major C. Peters	1st ,, ,,	6th April 1881	Surgeon-Major C. Peters	1st April 1881	6th April ,,	
		Do. John Robbs	7th ,, ,,	31st Mar. 1882	Do. John Robbs	7th ,, ,,	31st Dec. ,,	
					Shaik Adam	1st Jan. ,,	31st Mar. 1882	
Calicut	Storm Warning Service.	Henry Richardson, Esq., Port Officer	1st ,, ,,	31st ,, ,,	F D. Rozario	1st April ,,	31st ,, ,,	

---

[1] These officers are to receive a special good service allowance of Rs. 5 per month from the 1st April 1882.

APPENDIX F.

Administration Report of the Meteorological Reporter to the Government of Madras for the year 1881-82.

The Meteorological Department of the Madras Presidency, hitherto under the charge of the Government Astronomer, was separated from the Astronomical Department in July 1881. The establishment under the present Meteorological Superintendent comprises eleven old stations, at which observations have been recorded three times daily, *viz.*, at 10 A.M., 4 P.M., and 10 P.M.; and three new ones. The Madras Register is still kept at the Government Observatory, but is available to the Meteorological Reporter, thereby saving a separate record, otherwise requisite. The following is a complete list of the observatories which furnish returns in this Presidency:—

Madras.
Bangalore.
Bellary.
Cochin.
Coimbatore.
Madura.
Masulipatam.
Negapatam.
Salem.
Secunderabad.
Trichinopoly.
Wellington.
Amini Divi.
Mangalore.
Mercara.

MADRAS.

The observations at Madras were commenced in 1792, and have been continued with only one break, from 1807 to 1811, up to the present time. Hourly observations were taken continuously from March 1841 to April 1861, furnishing hourly corrections, strictly applicable to all places on the Eastern side of the Presidency, and rendering Madras, for all future time, a first-class station, at whatever hours observations may be recorded. For the West Coast stations, the hourly corrections deduced at Bombay would probably be more suitable.

All the barometers, dry and wet bulb thermometers, and anemometers, used while the Government Astronomer held charge, were compared with the Madras standards before being issued. The standard barometer No. 49, Newman, has a tube 0·514 inch in diameter, and is one of two sent out by the Royal Society in 1839. It was returned to England, to be thoroughly cleaned and repaired, in 1875, and, agreeably to subsequent comparisons with two excellent barometers from Calcutta, it does not appear to have undergone any change since its first arrival in India. The instrument is hung in a room, on the ground floor, in the Madras Observatory Office building; its cistern being twenty-two feet above sea-level.

The standard reference thermometer is one furnished from the Kew Observatory by Professor Balfour Stewart in 1861.

The dry and wet bulb thermometers in use since January 1st, 1868, are No. 2308, Negretti and Zambra. All the minimum thermometers are compared at 10 P.M., and the mean of the resulting corrections adopted for each month. The sun thermometer, *in vacuo*, is also compared at 10 P.M., as its readings are evidently affected by day-light and shew discordances, when compared by day-light, which do not exist amongst the night comparisons. The dry maximum thermometer is compared daily at 10 A.M. Records of a freely-exposed sun thermometer were formally kept, as well as of ozone; but both have been discontinued for some years past.

Prior to the establishment of the Madras Presidency Meteorological Department by my father, the Government Astronomer, in 1868, the thermometers at the Madras Observatory were recorded in a verandah facing the north; but as he did not consider them sufficiently exposed, fresh instruments were taken into use from the 1st of January, hung in a well-thatched shed about 50 yards from the verandah. The observations were continued in both places simultaneously for five years, to ascertain what difference the change of position made. It was found that while the mean temperatures in the shed and verandah were almost identical, the range was nearly half as much again in the shed as in the verandah.

A plan of the sheds, shewing the arrangement of the thermometers and other instruments, at Madras and at all the observatories started by my father, is given as a frontispiece. [1] The dimensions of the shed and of the thermometer-board are marked on the plan. Its roof consists of bamboo-matting, with a substantial thatching of straw, 6 inches thick, over it, to prevent the thermometers from being affected by sun or rain. At a few stations, where straw is difficult to obtain, the cadjan or palm-leaves, have been used instead, but straw is decidedly preferable. The side-screens are similarly constructed, but not quite so thick, and leaving a clear space of about 9 inches from the ground, to admit the free passage of the air, and yet to shield the thermometers from either direct or reflected sunshine. The small letters shewing the places of each thermometer on the stand need no explanation. The framework of each shed was made at the Madras Public Works workshops, and forwarded by the Government Astronomer to each up-country station, with a plan, and general instructions as to its erection and the placing of the thermometers.

The anemograph was constructed by the late Mr. Adie of London and Edinburgh, and after being highly commended at the Paris Exhibition in 1862, was forwarded to Madras, and taken into use in 1864. It is erected on the roof of the Government Astronomer's house, about 50 feet above the ground; the registration of wind velocity, direction, and rainfall being made by machinery, in a small room below. The standard rain-gauge is, of course, on the ground, as shewn in the plan of the shed; but the record, furnished by the anemograph gauge, enables the quantity collected on the ground to be proportionally divided, so as to shew at what time, and under what wind direction, it fell.

Notices of bad weather are given to the Marine Department, by the Government Astronomer, whenever considered necessary.

Code weather-messages for Bombay and Calcutta, as well as to Simla during the official season, are wired down to the Government Telegraph Office immediately after noon every day.

BANGALORE.

The register at this observatory was commenced in November 1867, and has been continued, without any serious breaks, up to the present time.

The barometer is in a room in the Bowring Hospital, facing south, and the thermometer-shed is erected on an open space, a considerable distance from any walls or buildings. The anemometer and wind-vane are placed on the top of the Market Serjeant's house, in the vicinity of the Hospital; the cups of the former being 30 feet above the surrounding ground and about 6 feet above the roof of the house.

The Assistant, O. Rungasawmy Moodaliar, is a careful, trustworthy observer, and having served twenty-three months at the Madras observatory before taking up his appointment, he reduces his observations accurately, and furnishes the records and registers punctually. Bangalore is one of the best-conducted Meteorological observatories in the Presidency, due, no doubt, in a great measure, to the able supervision of the successive Medical Officers in charge. This station was inspected by Mr. J. Eliot, while Officiating Meteorological Reporter to the Government of India, who reported as follows:—

"Inspected the Bangalore observatory, 13th January 1882. The barometer is well placed and in good order. The shed is in a very fair condition, and the instruments properly placed and in good order, except the wet-bulb, which was covered with a slight incrustation. The wind-vane and anemometer are both very dirty, and ought to be carefully cleaned, and, if necessary, the anemometer sent to Madras, after another has been procured. The remaining instruments are in good order. The observer does his work carefully, accurately, and neatly. The only suggestion I have to make is, that he should pay somewhat more attention to the cleanliness of his instruments."

BELLARY.

Records at this station were commenced in December 1867 and have been carried on in a satisfactory way ever since.

---

[1] Not received with the report.—H. F. B.

The barometer is placed in a small room adjoining the Civil Dispensary. The anemometer and wind-vane are fixed on a stand on the roof of the Civil Dispensary, 26 feet from the ground. Throughout the year 1881, the observations went on steadily, with the exception of two breaks in the records of the dry and wet minimum thermometers, the former from February 9th to September 2nd, and the latter from November 1st to December 20th. These instruments could not be replaced, as the reserve supply at Madras was exhausted. In accordance with Mr. Blanford's wishes hourly observations, on four days in each month, were started on the 21st of December. Synoptic, observations, taken daily, at the local time, corresponding to 7 A.M. Washington time, for the United States International Weather Bulletin, were also commenced from the same date. To prevent any misunderstanding in connection with the new duties required of the assistant, Dr. Archdall desired him to proceed to Madras, to receive further instructions; and as the mercury in the cistern of the barometer then in use was reported oxidised and in need of being cleaned, I thought this a favourable opportunity for changing it. A fresh instrument, duly compared with the Madras observatory standard, was accordingly sent in charge of the assistant, who took it into use at 10 A.M. on the 24th of December.

Bellary may be regarded as one of the fortunate stations, at which the Medical Officer in charge takes an interest in the work and signs the records and reductions before despatching them to me. Wherever this is the case, the observer is encouraged, and the result is more accurate, neater, and better work. The first assistant B. Sashachellum, is a careful, trustworthy man, and since his visit to the Madras Office, he has carried his duties on in a praiseworthy manner, reducing all his observations correctly, and enabling them to reach me in good time. From January to March the reductions were only partially done by him; from April to June by the Madras observatory assistants, and, since, by Sashachellum. A second assistant, on a salary of Rs. 10, has been employed at this station to help the first in taking the hourly observations, since December.

COCHIN.

This station was started in February 1868, and although the same amount of care was taken in supplying properly compared instruments and instructing an assistant, the work was for some time in a most unsatisfactory state. Being considered an unhealthy place for natives, there has always been some difficulty in getting an assistant willing to undertake the duties there, in consequence of which Eurasians have been employed on several occasions, and the result has too frequently been a complete failure. Since the appointment of the present assistant, Narayanasawmy, the records have been quite trustworthy, but ill-health has of late, caused him to make repeated applications to be transferred to another station.

The barometer is placed in a small room facing westward. The thermometer-shed is in the Hospital compound, and there are extensive cocoanut plantations at some distance to the east and south, with a backwater 300 yards distant. The anemometer is fixed on a wooden column, about 2 feet above the roof of the shed and is secured to its northern pole. Throughout the year 1881 the work at this station has been very good indeed.

The assistant has reduced his observations regularly and correctly, and they have been forwarded to me generally within a week after date. The instruments were in fair condition, with the exception of the sum maximum thermometer, which got out of order several times, and the anemometer, the readings of which were worthless, owing to one of the cups having been broken off and soldered on in the bazaar.

COIMBATORE.

The records from this station date from the 15th of November 1867, and, throughout the time, the work has been excellent.

The barometer is placed in a room at the east end of the Hospital, facing north. The anemometer is fixed on the southern end of the thermometer-shed, at a height of 14 feet from the ground, and the shed is erected at a distance of about 36 feet east of the Hospital. The work at this observatory during the year 1881, has been quite satisfactory.

The Assistant is a careful, trustworthy man, and having been employed in the Madras observatory from January 1852 to July 1877, when he was transferred to Coimbatore, he is well practised at his work and reduces his observations without any difficulty. The records and reductions generally reach this Office within a week or ten days after the end of each month.

MADURA.

The observations at this station commenced on the 6th of February 1868.

The barometer is kept in the consulting room of the Dispensary, about 22 feet above the ground. The thermometer-shed is placed in the centre of a large square, bounded on the west by a cocoanut tope, on the north by a public road and an avenue of trees, and open for some considerable distance on the other two sides. The anemometer is on the roof of one of the Dispensary buildings and is 31 feet above the level of the ground; but there are several trees in the neighbourhood, which must influence the readings, though, as no better site could be found, this is unavoidable. The records during 1881, were incomplete, owing to the breakage of the wet minimum thermometer. The comparisons of the grass minimum were also incorrect, due, most probably, to the instrument having been placed on its stand at 4 P.M., instead of leaving it in the shed till 10 P.M., and comparing it before exposing it for the night.

The Assistant was taught to record and reduce his observations at the Madras observatory, and he can do the work when he pleases; but throughout 1881, no attempt was made at the latter, and consequently all reductions had to be made in the Madras Office. This station was inspected by Mr. J. Eliot, while Officiating Meteorological Reporter to the Government of India, when he reported as follows:—

"Inspected the observatory on the 15th of January 1882. The shed and instruments are generally in good condition and properly placed. The only suggestions I have to make are the following:—

1st.—That the small compound in which the shed is placed should be cleaned out; the trees and shrubs, more especially those in the west corner, being removed, so that the exposure of the instruments may be as perfect as possible.

2nd.—That the barometer should be returned to Madras, in exchange for another, in which the mercury is cleaner, at an early opportunity.

3rd.—That the anemometer should be rigidly fixed to its support.

I am quite satisfied with the condition of the observatory. The observer, I may add, takes the observations accurately and his records appear to be in good order."

MASULIPATAM.

The Government Astronomer superintended the erection of the thermometer-shed and instruments, instructed the assistant and started the observations in August 1868, during the Total Solar Eclipse Expedition of that year, and the work has been carried on in a fairly satisfactory way ever since.

The barometer is fixed on a wall, facing the east, in the Meteorological Office room, in the Civil Dispensary, and is so placed that neither currents of wind can blow, nor too much light can fall on it to vitiate its readings in any degree. The thermometer board in the shed faces due north, and the instruments are in a line with the centre of the two side-screens. The sun-thermometer and the rain-gauge are placed out of the shed, within the posts and tarred ropes, just as pointed out in the lithographed plan of thermometer-shed, shewing the general arrangement of all the instruments. Throughout 1881, the observations have been carried on steadily, but no anemometer has yet been put up, owing to difficulties in getting a staging erected for the instrument.

I believe the assistant does his best in recording the observations, but he has never reduced any: he appears anxious to learn, but will not come to Madras to be instructed, although strongly advised to do so, both by Mr. Eliot and myself. It is rarely possible to teach an assistant to reduce his observations, according to the plan adopted at Madras, by letter. The records from this station were pretty punctually submitted to me for reduction, and the staging for the anemometer is now ready, thanks to the interest taken in the observatory by Dr. W. H. Thornhill, who had charge of the station during the year.

NEGAPATAM.

Observations at this station were commenced on June 1st, 1868, by an observatory assistant, who was transferred, and having been well accustomed to recording hourly observations for many years at Madras, was well up to his work, and carried it on creditably until he retired. In November 1871 the thermometer-shed was blown away during a storm, which caused a break of some months in the records.

The barometer is placed in a room in the south-eastern part of the Hospital, 13 feet long, 8 broad, and 15 high, with a large window facing the sea. A pandal, which extends over the window, prevents rain or sun from entering the room. The shed in which the thermometers are placed is situated within the compound of the Hospital, on the northern side, and opposite to the Office of the Doctor in charge, and a few yards from the main road. The shed is strongly thatched. The stand of the thermometers is fixed facing the north. The fork for the sun and grass thermometers is farther south, and the rain-gauge stand is raised about 18 inches above the surrounding ground. All these are defended by rails, to keep out cattle; and the entrance at the south end is guarded by a stile. The anemometer and wind-vane are placed near each other, 30 feet above the level of the surrounding ground, on the north-western part of the upper story of the Hospital building. The records, during 1881, were not very satisfactory, some of the wet minimum thermometer readings having to be rejected, and several of the records of the grass minimum being questionable.

The assistant was taught to record and reduce his observations before being appointed, and can do his work well; but having taken the observations, he is dilatory in regard to their reductions, and so, up to October, these had to be done at the Madras Office. Since then, however, I am glad to remark, he has improved, and the records and reductions have been forwarded in better time. Mr. J. Eliot, while Officiating Meteorological Reporter to the Government of India, visited this station, and made the following favourable report of the state in which he found everything:—

"Inspected the Negapatam observatory, 16th January 1882. The shed is well placed, open in all directions and in good order. The various instruments are all clean and in perfectly good order. The observer takes the observations accurately and intelligently. The condition of the observatory is very satisfactory and creditable to the observer. In future, hourly or bi-hourly telegraphic weather-reports will occasionally be asked for by telegram from Calcutta during stormy weather. These telegrams should be continued until the receipt of a telegram from Calcutta that they may be discontinued."

SALEM.

This station was started on the 1st of November 1867, and has been one of the most satisfactory in the Presidency. As at Negapatam, a good trustworthy assistant, who had served for many years in the Madras observatory, and participated in recording and reducing the hourly observations, was transferred to Salem, where he remained until pensioned in November 1874.

The barometer is kept in a small room, about 10 feet square, forming the north-east angle of the In-patient Department of the Civil Dispensary, facing north, with a window opposite and a door on the eastern side. The thermometer-shed is in the Cutcherry compound, so placed on account of its being under the protection of the Treasury Guard, and is built strictly in accordance with standing orders, 96 feet from the Cutcherry buildings and 74 feet from the enclosing wall of the compound. The anemometer and wind-vane are placed over the flat roof of the Cutcherry, at its south-west angle, the position being such that adjoining buildings and trees shall least impede the free access of wind. The cups are 32 feet above the ground. The records throughout 1881 have been satisfactory.

The assistant works neatly and accurately, but he is dilatory about submitting his records, and though he understands reducing the observations, he never attempted anything of the kind throughout the year.

SECUNDERABAD.

The records at this station were commenced on the 1st of November 1867; but the results have never been satisfactory, owing to the inefficiency of the assistant, who was appointed upon the strong recommendation of the Secretary to the Sanitary Commissioner, who was formerly the Medical Officer in charge, without having had any previous training at the Madras observatory. The records were made throughout 1881, but little reliance can be placed on them. The Secunderabad station was visited by Mr. J. Eliot during his tour in this Presidency, while Officiating Meteorological Reporter to the Government of India, when he reported as follows:—

"Inspected the Secunderabad observatory, 21st January 1882. The instruments were generally very dirty. The wet bulbs were covered with a thick incrustation, and the remaining thermometers were more or less coated with dust. The grass radiation thermometer, although in use, was quite out of order, three separate portions being detached from the main column. The vertical support of the wind-vane is several degrees out of the vertical. The anemometer is quite loosely attached to its wooden base. There is no receptacle for the rain-fall in the rain-gauge. Altogether, the condition of the observatory was most unsatisfactory. The observer is quite unable to read the anemometer, and the previous wind-returns are worthless. He does not reduce his observations like other observers in the Madras Presidency, although he receives the full forty rupees per mensem. I am also quite convinced in my own mind that he has not taken the observations accurately at the hours laid down by the Madras Reporter. Under these circumstances, it appears to me that the previous Meteorological Observations of this observatory are of little or no value, and that it is therefore, necessary to place it on a different footing, in order that Government may have faithful, honest, and accurate work done in return for the money expended. The present observer will therefore, be very shortly relieved by a competent observer, who will be sent from Madras; but until his arrival, he will take the observations as hitherto. He may apply for pension, but its grant will depend mainly upon the opinion of the previous and present Meteorological Reporters, as to whether he deserves it, and also upon the manner in which he does his work up to the arrival of the new observer and in which he makes over charge of the observatory."

In accordance with the above, a new assistant was instructed at the Madras observatory, both to record and reduce the observations, and was sent to Secunderabad in charge of a fresh barometer and several other instruments. Since the appointment of Mr. Williams on the 27th of February, I am pleased to state that there has been a thorough change in the work, which I hope will continue. The reductions are now made at Secunderabad, and forwarded to me, together with the records, within a week or ten days after the end of each month.

TRICHINOPOLY.

Observations at this station commenced on the 1st of December 1867. The barometer hangs on the south wall of a small room, facing east, and the cistern is about 18 inches from the ground. The thermometer-shed is well adapted for its purpose, being in an open space, well exposed, and with a well-thatched roof. The sun thermometer is about a foot from the ground. The rain-gauge is well placed, and the anemometer and wind-vane are freely exposed to every current of air. The anemometer cups are 24 feet above the ground, and the wind-vane is about 2 feet higher. The records at this observatory throughout the year 1881 were very good, no breaks having occurred. As at Bellary, hourly observations, on four days in each month, were started from the 7th of December, and a series of Synoptic observations were taken at the local time, corresponding to 7 A.M. Washington Mean Time, for the United States "International Weather Bulletin." It is, therefore, necessary that the records and results should be forwarded to the Madras Office with as little delay as possible; but I regret to state that it is only after repeated enquiries, threats of suspension and fines, that the assistant at Trichinopoly sends me his records; and though he was taught at Madras to reduce his observations, he did not do any in 1881, and has only commenced lately, still neglecting the reduction of the hourly observations. On the whole, I consider Lutchman Row exceedingly negligent, and unless he improves, I would strongly advise his pay being diminished, to enable me to employ another assistant at my Office to finish his work. I believe him to be a capable observer, if better disposed; but he lacks energy.

WELLINGTON.

This station was started in March 1870, and for some years the work went on very creditably, in charge of Serjeant J. Coghlan, who was duly trained for his duties at Madras. Between 1877 and 1880 several changes took place, and as the Hospital Serjeant was at that time always the observer, whether qualified or not, the records deteriorated, until they became utterly worthless. The appointment of pensioned Serjeant H. Brownsell as permanent assistant in August 1880, restored the observatory to its former efficiency, as he had not only received proper instructions at Madras in 1874, but had subsequently filled the post of observer at Bellary most satisfactorily, until his retirement on pension in 1878.

The barometer is fixed against the wall of a room belonging to the Hospital. The thermometer-shed is situated on the Hospital plateau, and was carefully placed due north and south. There was some difficulty in finding a suitable site for the anemometer, in consequence of which this instrument has not yet been brought into use; but the erection of the staging is in progress and it will soon be ready for the instrument. With the exception of the sun maximum thermometer, the records were complete, and the instruments in good order throughout 1881.

The assistant partially reduced his observations, till September, since then they have been done at Madras; but as soon as the new forms are obtained, I hope he will do the reductions completely. The records are forwarded to me generally within a week after date.

AMINI DIVI.

Barometric records were started three times daily, at 10 A.M., 4 P.M., and 10 P.M., in September 1880, and registers of the thermometers have been kept since July 1st, 1881, and of the anemometer since December 1st.

The observer, Syed Abdool Rahman, Second Class Hospital Assistant, attached to the Laccadive Islands, was instructed both to record and reduce his observations at the Madras observatory, when he appeared intelligent and anxious to undertake the duties.

A barometer, duly compared with the Madras Standard, was sent in charge of the assistant, and a complete supply of thermometers and other necessary instruments were supplied from Calcutta. The records from this station are forwarded when possible; but owing to there being no Post, and, for several months in the year, no communication with the islands, they cannot reach my Office at regular times. They have, however, been received up to December last, and are now being reduced at Madras. As it is a third-class station, the observer is only required to record observations twice daily; but they have been taken so far thrice daily, as at other stations in the Presidency. It is to be regretted that, as the Hospital Assistant has to go on circuit for several weeks together, there must be frequent breaks in the registers, rendering the work incomplete. He was away on privilege leave for three months, and as no substitute could be found to carry on his duties, another break would be thereby inevitable. Unless a man can be specially appointed to take charge of the Meteorology at this station, it seems almost useless to continue it. I would suggest that special arrangements might be made, to enable the work to be kept up regularly in future.

MANGALORE.

This being a third-class station, observations are recorded only twice daily, *viz.*, at 10 A.M. and 4 P.M. It is under the care of the Telegraph Master, who reads the instruments himself and forwards the records to the Madras Office every week. This station was transferred to me by the Meteorological Reporter to the Government of India on the 1st of January 1881. The records await reduction. As the instruments in use at this observatory were supplied from Calcutta, any further remarks are unnecessary.

MERCARA.

Like the above, this is a third-class observatory, recording observations at 10 A.M. and 4 P.M only, and the duty is carried on by the Telegraph Master, who despatches his records to my Office regularly every week. The registers will be reduced as soon as time permits. This station was also transferred to me from the 1st of January 1882. All the instruments were supplied from the Head Office at Calcutta.

From the foregoing brief descriptions, it will be seen that, with the exception of one station, the work has been very satisfactory throughout the year, for which special thanks are due to the Medical Officers in charge, for their able supervision and general interest in the work. Breakages of instruments are at once reported to this Office, enabling me to replace them without serious interruptions in the returns. As will be seen from one of the Tables, several new instruments were immediately despatched to various stations, on the receipt of a supply from Calcutta.

All the barometers and anemometers have been carefully compared with the standards at the Madras observatory, since the Department started in 1867—in most cases by the Government Astronomer himself.

The Madras Meteorological Office Establishment, on the 31st of December, consisted of but one assistant, who was sanctioned by the Madras Government in 1877; previous to which time, all the reductions were done by the observatory assistants, four of whom have been constantly employed in the same work until lately. On applying to Mr. Blanford for a copying clerk and a peon, these were granted in March; the former on a salary of Rs. 20, and the latter on Rs. 8 per mensem. The time has now arrived when the Government Astronomer will have to publish his Astronomical Works, and he can no longer spare his assistants for other duties than those of the observatory It is therefore absolutely necessary that at least two, if not three, extra assistants should be employed at Madras, to keep the work regularly up to date, and to enable me to supply copies of all the results to the Meteorological Reporter to the Government of India soon after the end of each month, as I intended on taking charge. Although most of the assistants up-country now reduce their observations, it is necessary to have all the registers revised at my Office, and such revision takes nearly all the time of the most trustworthy assistant at Madras. The second assistant finds occupation enough in making the required number of copies, consequently some part of the work must fall back. The introduction of Tension of Vapour caused new Forms, with the necessary additional columns to be required, and the slow progress of printing has prevented the despatch of returns so far, since December last. Few of the assistants have yet acquired dexterity in the use of the Tension Tables, and in all cases the numbers require checking at Madras, while in nearly all, the whole of the work had to be done in my Office.

Rain Reports are forwarded from numerous Revenue Board Stations to the Government Astronomer, and it is probable that these will shortly be handed over to the care of the Meteorological Superintendent. New and carefully-tested rain-gauges and glasses were supplied to 226 of the rain stations by the Government Astronomer, and it is only from such places that the returns are accepted, and the results tabulated in the Meteorological Supplement to the *Fort St. George Gazette.* The gauges were made at the Madras Public Works workshops, and were all tested as to size of funnel and contents of glass-measure at the observatory, so that the uncertainty should be within 0.005 per inch of rainfall.

ELIZABETH ISIS POGSON,
Meteorological Reporter, Government of Madras.

METEOROLOGICAL OFFICE, MADRAS;
The 15th July 1882.

APPENDIX F. I.

Complete List of Officers in Charge and Assistants in the Madras Presidency Meteorological Department in the official year 1881-82.

STATION.	Officer in Charge.	From	To	Assistant.	From	To
Madras	N. R. Pogson, Esq., C.I.E., Government Astronomer	1st April 1867	24th July 1881	J. Vythinatha Iyer, First	1st February 1878	31st March 1882
	Miss E. Isis Pogson, Meteorological Reporter	25th July 1881	31st March 1882	N. E. Kangayam Pillay, Second	1st March 1882	31st March ,,
Amini Divi	Syed Abdool Rahaman	......	31st March ,,	None	...	...
Bangalore	Surgeon P. H. Benson, M.B.	1st April ,,	31st March ,,	Rungasawmy Moodaliar	1st September 1871	31st March ,,
Bellary	Surgeon-Major H. M. G. Archdall	11th February ,,	31st March ,,	B. G. Sashachellum, First	31st August 1878	31st March ,,
				Sreenevasa Row, Second	21st December 1881	31st March ,,
Cochin	Surgeon-Major W. H. Morgan	30th April 1878	7th March ,,	G. Narayanasawmy	7th November 1880	31st March ,,
	Surgeon A. J. O'Hara	8th March 1882	31st March ,,	......	...	...
Coimbatore	Surgeon-Major G. E. Whitton, M.B. & B.A.	9th January 1880	6th March ,,	Varadiah Naidu	1st July 1877	31st March ,,
	Surgeon G. M. E. McKee	7th March 1882	31st March ,,	......	...	...
Madura	Surgeon J. Lancaster, M.B.	18th June 1880	31st March ,,	V. Sashachellum	19th November 1867	31st March ,,
Mangalore	Telegraph Master	......	31st March ,,	None	...	...
Masulipatam	Surgeon W. H. Thornhill, M.D., M.C. & B.A.	18th March 1881	2nd March ,,	Uma Ranganayakulu Naidu	1st August 1868	31st March ,,
	Surgeon F. J. Doyle	3rd March 1882	31st March ,,	......	...	...
Mercara	Telegraph Master, H. Duckworth	......	31st March ,,	None	...	...
Negapatam	E. A. Morris, Esq., L.R.C.P. & L.R.C.S.E.	15th November 1880	31st March ,,	S. Saminatha Iyer	5th September 1874	31st March ,,
Salem	Surgeon-Major H. J. Haylett	2nd November ,,	31st March ,,	L. Ramsing	13th October 1880	31st March ,,
Secunderabad	Surgeon J. J. Moran, M.D.	29th December ,,	17th August 1881	V. Coopoosawmy	1st November 1867	26th February ,,
	Surgeon A. P. Adams	18th August 1881	6th November ,,	J. T. Williams	27th February 1882	31st March ,,
	Surgeon E. M. Damla	7th November ,,	31st March 1882	......	...	...
Trichinopoly	Surgeon-Major J. B. Thomas, L.R.C.P.L.	3rd December 1879	31st March ,,	T. Lutchman Row, First	21st November 1874	31st March ,,
				E. M. Bhojarajoloo, Naidu, Second	1st December 1881	31st March ,,
Wellington	Surgeon-Major R. Waters, M.D.	1st April 1881	8th February 1882	Sergeant H. Brounsell	1st August 1880	31st March ,,
	Surgeon-Major J. Fleming, M.D.	9th February 1882	31st March ,,	......	...	...

APPENDIX G.

Statement showing the names of Superintendents and Observers of the Observatories in British Burma for the official year 1881-82.

Stations.	Names.	Appointments.	Remarks.
Rangoon	Surgeon-Major H. Johnstone	Superintendent	Joined 22nd May 1878. On furlough to Europe from 24th March 1882.
	Ditto D. Sinclair	Ditto	Joined 24th March 1882.
	A. E. Sarfas	Observer	....
	Moung Yam Hmoo	Assistant Observer	„ 15th March 1881, left on 1st March 1882.
	A. V. Peramal	Ditto	„ 1st May 1881.
Moulmein	Surgeon-Major W. F. deFabeck, M.D., M.R.C.S.L.	Superintendent	Throughout the year.
	Hospital Assistant F. Hilbert	Observer	
Bassein	Dr. Oswald Baker, Surgeon, Indian Medical Department, Civil Surgeon, Bassein	Superintendent	From 1st April to 31st October 1881.
	Dr. S. H. Dantra, Surgeon, Indian Medical Department, Civil Surgeon, Bassein	Ditto	„ 1st November 1881 to 31st March 1882.
	Ah Guway Soon	Observer	Throughout the year.
Thyetmio	B. N. Chowdry, Asst. Surg.	Superintendent	From 1st April to 3rd May 1881.
	Alla Deen, 2nd Class Hospital Assistant	Ditto	„ 4th May to 7th May 1881.
	E. P. Frenchman, Surgeon, I.M.D.	Ditto	„ 7th May to 13th June 1881.
	P. W. Dalzell, ditto	Ditto	„ 13th June to 13th December 1881.
	Alla Deen, 2nd Class, Hospital Assistant	Ditto	„ 14th December to 29th December 1881.
	P. W. Dalzell, Surgeon, I.M.D.	Ditto	„ 29th December 1881 to 31st March 1882.
	Alla Deen, 2nd Class Hospital Asst.	Observer	Throughout the year.
Mergui	Asst. Surg. Devendranath Roy	Superintendent	From 1st to 8th April 1881.
	Ditto Kally Dass Bose	Ditto	„ 9th April to 2nd May 1881.
	Hospital Assistant Rajub Ally	Ditto	„ 3rd May to 6th August 1881.
	Assistant Surgeon Omerto Lal Moonshee	Ditto	„ 7th August 1881 to 31st March 1882.
	Mahomed Cassim	Observer	„ 1st April 1881 to 31st March 1882.
Tounghoo	Surgeon H. Pemberton	Superintendent	From 1st April to 28th April 1881.
	Ditto C. Rundle	Ditto	„ 29th April 1881 to 16th February 1882.
	Ditto H. Pemberton	Ditto	„ 17th February to 31st March 1882.
	3rd Class, Hospital Assistant, V. Chinasawmy Pillai	Observer	„ 1st April 1881 to 31st October 1881.
	2nd Class, Hospital Assistant, V. Venkatasawmy Naidu	Ditto	„ 1st November 1881 to 16th February 1882.
	3rd Class, Hospital Assistant, V. Chinasawmy Pillai	Ditto	„ 17th February to 31st March 1882.

RANGOON;
The 22nd May 1882.

A. W. KELLY,
Sanitary Commissioner, British Burma.

APPENDIX H.

Return of the Names of the Superintendents and Observers at the Port Blair and Nancowry Observatories during the year 1881-82.

Port Blair.			Nancowry.		
Names.	From	To	Names.	From	To
Superintendents.			*Superintendents.*		
Surgeon W. Beatson	1st April 1881	28th Dec. 1881	*None.*		
" J. Reid, M.B	29th Dec. 1881	31st March 1882	......		
Observers.			*Observers.*		
J. T. Peters	1st April 1881	31st March 1882	D. Guanayathum	1st April 1881	20th May 1881
			V. Nummiah	21st May 1881	11th Aug. 1881
			C. Soobroyaloo Naidu.	12th Aug. 1881	28th Jan. 1882
			S. Thomas	29th Jan. 1882	31st March 1882

Port Blair,
The 1st April 1882.

JAMES REID, M. B., *Surgeon,*
Senior Medical Officer,
Port Blair, Nicobars.

APPENDIX I.

List of Recipients of the Publications of the Meteorological Office.

Adelaide	Director of the Meteorological Observatory.
Agra	The Editor of the *Delhi Gazette*.
Ajmere	Secretary to the Chief Commissioner of Ajmere.
Akola	Sanitary Commissioner for Berar.
Algeria	Le Général Commandant Superieur du Genie en Algerie.
Allahabad	Secretary to the Government, North-Western Provinces and Oudh.
	Director, Department of Revenue and Agriculture, North-Western Provinces an Oudh.
	Meteorological Reporter, North-Western Provinces and Oudh.
	Sanitary Commissioner, ditto ditto.
	Editor of the *Pioneer*.
Amsterdam	Secretary to the Royal Academy of Sciences.
Bangalore	Secretary to the Chief Commissioner, Mysore and Coorg.
	Conservator of Forests, Mysore and Coorg.
Batavia, Java	Director of the Meteorological Observatory.
Berlin	Ditto ditto Institute.
Bombay	Secretary to the Government of Bombay.
	Meteorological Reporter for Western India.
	Superintendent of the Colaba Observatory.
	Sanitary Commissioner with the Government of Bombay.
	Registrar of the Bombay University.
	Secretary to the Asiatic Society of Bombay.
	Superintendent of the Bombay Sassoon Mechanics' Institute.
	Secretary to the Geographical Society of Bombay.
	Editor of the *Bombay Gazette*.
	Ditto *Times of India*.
	Principal of the Elphinstone College.
Brisbane Queensland	Superintendent of the Observatory.
Brussels	Secretary to the Royal Academy of Sciences.
	Director of the Observatoire Royal.
Budapesth	Ditto Observatory.
Buenos Aires	Ditto Meteorological Office.
Calcutta	Secretary of State for India (through Revenue and Agricultural Department).
	Secretary to the Government of India, Revenue and Agricultural Department.
	Ditto ditto, Home Department.

Calcutta	Secretary to the Government of India, Public Works Department.
	Ditto ditto, Foreign Department.
	Ditto ditto, Department of Finance and Commerce.
	Ditto ditto, Military Department.
	Private Secretary to His Excellency the Viceroy.
	Secretary to the Government of Bengal, Revenue Department.
	Meteorological Reporter to the Government of Bengal.
	Surveyor General of India.
	Superintendent, Geological Survey of India.
	Sanitary Commissioner with the Government of India.
	Ditto ditto ditto Bengal.
	Superintendent, Botanic Gardens, Calcutta.
	Inspector General of Forests, with the Government of India.
	Secretary to the Surgeon-General, ditto ditto.
	Ditto Asiatic Society, Bengal.
	Librarian, Indian Museum Library.
	Registrar of the Calcutta University.
	Principal of the Presidency College.
	Librarian, Public Library.
	Editor of the *Calcutta Review.*
	Ditto *Statesman and Friend of India.*
	Ditto *Englishman.*
	Ditto *Indian Daily News.*
	Ditto *Hindoo Patriot.*
	Ditto *Indian Agriculturist.*
	Reverend E. Lafont, S.J.
Cambridge	Librarian of the University Library.
Cambridge, Massachusetts	Ditto Harvard University.
Cape of Good Hope	Astronomer Royal.
Carlsruhe, Germany	Director of the Baden Meteorological Observatory.
Chemnitz	Director of the Royal Meteorological Institute.
Chatham	Librarian, Royal Engineers' Library.
Christiania	Director of the Norske Meteorologiske Institut.
	Ditto Royal Observatory.
Colombo	Editor of the *Ceylon Times.*
	Ditto *Ceylon Observer.*
	Surveyor General of Ceylon.
Constantinople	Director of the Observatoire Imperial Météorologique.
Copenhagen	Secretary to the Danske Meteorologiske Institut.
	Ditto Royal Danish Academy of Sciences.
Cordoba	Director, Meteorological Office.
Darjeeling	Conservator of Forests, Government of Bengal.
	Editor of the *Indian Forester.*
Dehra Dun	Superintendent, Great Trigonometrical Survey.
Dharwar	Conservator of Forests, Bombay, Southern Division.
Dublin	Registrar, Royal Dublin Society.
Edinburgh	Secretary to the Scottish Meteorological Society.
	Astronomer Royal for Scotland, Royal Observatory.
Ellichpore	Assistant Conservator of Forests, Melghat Division.
Goa	Director General, Royal Observatory.
Greenwich	Astronomer Royal, Royal Observatory.
Guatemala	Director of the Observatorio Meteorologico del Institut Nacional de Guatemala.
Hamburgh	Director of the Nord Deutsche Seewarte.
Havana	Ditto Real Collegio de Belen.
Hong-Kong	Superintendent, Government Civil Hospital.
Indore	First Assistant Agent to the Governor General for Central India in charge of the Residency.
Iowa, U. S	Director of the Iowa Weather Service.
Jubbulpore	Civil Surgeon of Jubbulpore.

List of Recipients of the Publications of the Meteorological Office—continued.

Katmandu	Resident at Nepal.
Khandwa	Civil Surgeon of Nimar.
Kitzingen, Bavaria	Dr. Emil Von Schlagintweit.
Kurrachee	Conservator of Forests, Bombay, Sind Division.
Lahore	Secretary to the Government of the Punjab.
	Meteorological Reporter ditto ditto.
	Sanitary Commissioner ditto ditto.
	Conservator of Forests, Government of the Punjab.
	Editor of the *Indian Public Opinion.*
Lisbon	Director of the Observatoire de Infante D'Luiz.
	Secretary to the Academy of Sciences.
London	Secretary to the Meteorological Council.
	Ditto Royal Society.
	Ditto Royal Asiatic Society.
	Ditto Society of Arts.
	Ditto Meteorological Society.
	Ditto Institution of Civil Engineers.
	Librarian, Royal School of Mines.
	Ditto Admiralty Library.
	Ditto United Service Museum.
	Chief Librarian, British Museum.
	Editor of the *Philosophical Magazine.*
	Ditto *Athenæum.*
	Ditto *Nature.*
	Ditto *Symons' Monthly Meteorological Magazine.*
	Ditto *Westminister Review.*
	Ditto *Quarterly Review.*
Madras	Secretary to the Government of Madras.
	Ditto ditto Public Works Department, Irrigation Branch.
	Meteorological Superintendent to the Government of Madras.
	Government Astronomer, Madras.
	Sanitary Commissioner, Government of Madras.
	Registrar of the Madras University.
	Editor of the *Madras Times.*
	Ditto *Madras Athenæum.*
	Ditto *Madras Mail.*
	Superintendent, Government Central Museum.
	Ditto ditto Firm, Saidapet.
	Surgeon General, British Medical Department.
	Ditto Indian Medical Department.
	Master Attendant of Madras.
Madrid	Director of the Royal Observatory.
Manchester	Secretary to the Literary and Philosophical Society.
Manila	Director of the Meteorological Observatory.
Mauritius	Secretary to the Meteorological Society.
Melbourne, Victoria	Director of the Observatory.
	Librarian of the University Library.
	President of the Public Library.
Mexico	Director of the Central Meteorological Observatory.
Milan	Ditto Royal Astronomical Observatory.
Munich	Ditto Royal Observatory.
	Ditto Royal Bavarian Academy of Sciences.
	President, Geographical Society.
	The Publishers of the *Deutsche Rundschau für Geographie und Statistik.*
Nagpur	Secretary to the Chief Commissioner, Central Provinces.
	Sanitary Commissioner, ditto.
	Inspector General of Education, ditto.
	Civil Surgeon, Central Jail.

Nagpur	Conservator of Forests, Central Provinces.
Naini Tal	Ditto ditto North-Western Provinces and Oudh.
New Haven, Connecticut	Secretary to the Connecticut Academy of Arts and Sciences.
	Editors of the *American Journal of Sciences.*
New York, U. S.	Director of the Central Park Observatory.
Ootacamund	Conservator of Forests, Government of Madras.
	Editor of the *South of India Observer.*
Oxford	Librarian of the Radcliffe Library.
	Radcliffe Observer, Radcliffe Observatory.
Paris	Director, Observatoire Physique Central de Montsouris.
	Editor of *La Nature.*
	Director of the Physical Observatory, Meudon.
	Ditto Bureau Central Meteorologique.
Perpignan, France	President Commission Meterol. des Pyrénéss Orientales.
Perth, W. Australia	Surveyor General.
Pesaro, Italy	Director of the Royal Observatory.
Philadelphia	Secretary to the Franklin Institute.
Poona	Conservator of Forests, Bombay Northern Division.
Prag, Bohemia	Director of the Observatory.
Raipur	Civil Surgeon of Raipur.
Rangoon	Secretary to the Chief Commissioner, British Burmah.
	Sanitary Commissioner, ditto.
	Conservator of Forests, ditto.
	Editor of the *Rangoon Times.*
Rome	Director, Meteorological Office (Ministry of Agriculture).
Saharanpur	Superintendent, Botanic Gardens.
Secunderabad	Secretary to the Resident at Hyderabad.
Shillong	Ditto Chief Commissioner of Assam.
	Deputy Conservator of Forests, ditto.
Simla	Quarter Master General of India, Intelligence Branch.
Singapur	Colonial Surgeon, Straits Settlements.
Stockholm	Director of the Nautisk Meteorologiska Byran.
St. Petersburgh	Ditto Observatoire Physique Central.
Strasbourg	Librarian, Imperial University Library.
Sydney	Director of the Observatory.
	Librarian of the University Library.
Syracuse, Sicily	Director of the Royal Meteorological Observatory.
Tasmania	Secretary to the Royal Society.
Tiflis, Russia	Director of the Physical Observatory.
Tokei, Japan	Ditto Imperial Mining Office.
	Ditto Imperial Meteorological Observatory.
Toronto, Canada	Ditto Magnetical and Meteorological Observatory.
Turin	Ditto R. Osservatorio Astronomico di Torino.
Upsala	Ditto Meteorological Observatory.
Utrecht	Secretary to the Royal Dutch Meteorological Institute.
Vienna	Director of the K. K. Central Anstalt für Meteorologie und Erdmagnetismus.
	Ditto K. K. Geologische Reichsanstalt.
	Secretary to the Imperial Academy of Sciences.
	Dr. J. Hann.
Vizagapatam	A. V. Nursingrow, Esquire.
Washington, U. S.	Chief Signal Officer, United States Army.
	Secretary to the Smithsonian Institution.
	Director of the Naval Observatory.
	Ditto Hydrographic Office.
	Professor Cleveland Abbe, Signal Office.
Wellington, New Zealand	Director of the Observatory.
Woolwich	Librarian of the Royal Artillery Library.
Zi-ka-wei, Schanghai	Director of the Magnetical and Meteorological Observatory.
Zurich	Ditto Central Meteorological Institute.

APPENDIX J.

Presentations to the Library from the 1st April 1881 to the 31st March 1882.

Place.	Donor.	Title of Work.
ALGIERS	Meteorological Service	Bulletin Météorologique du Gouvernement général de l' Algerie, Nos. 1915—2239, 2241—2279.
		Tableau récapitulatif des quantités des pluies; September to December 1880, and January to December 1881.
		Résumé climatologique, September to December 1880, Year 1880, and January to December 1881.
		Observations météorologiques du réseau Africain; Années 1878 and 1879.
		Quantités de pluie, September 1880 to August 1881.
		Sur les variations ou inégalités périodiques de la température; (dixiéme et onziéme Note), Période du vingtiéme jour dodécuplé.
		Le climat de l'empire Russe.
		Regime pluvial de l'Algérie; 1850—1880, and 1851 to 1880.
		Organisation actuelle du Service météorologique en Europe.
		Généralités sur la geographie and météorologie de l'Algérie.
AMSTERDAM	Royal Academy of Sciences	Processen Verbaal 1879-80.
		Jaarboek 1879.
		Verslagen en mededeelingen, afd Natuurkunde, Tweede Reeks, Vol. XV.
ALLAHABAD	Meteorological Office	Administration Report of the Meteorological Reporter to the Government of the North-Western Provinces and Oudh for the year 1880-81.
		Sketch of the Meteorology of the year 1880 in the North-Western Provinces and Oudh and Eastern Rajputana.
BRUSSELS	Observatoire Royal de Bruxelles	Catalogue des ouvrages d'Astronomie et de météorologie en Belgique, 1878.
		Observations météorologiques, November and December 1879.
		Annales météorologiques—Deuxiéme Série, Tome I of 1876.
		Annuaire, 1880 and 1881.
		Observations des stations climatologiques; Annéé 1879, January to April 1880.
		Observations météorologiques faites aux stations internationales de la Belgique et des Pays Bas, June—December, and Résumé, 1879; January 1880.
	Royal Academy of Sciences	Bulletins, Tomes 46 to 50.
		Annuaire; 1879—1881.
	Dr. Fuchs	Géologie de la Belgique, par Michel Mourton.
	Ch. Feivez	Note Sur l'analyse de la lumiére de la comete (6) de 1881.
		Recherches Sur l'élargissement des raies spectrales de l'hydrogene.
BUDAPESTH	Central Anstalt für Meteorologie und Erdmagnetismus.	Jahrbücher, Band VIII, 1878; Band IX, 1879.
BOMBAY	Meteorological Office	Administration Report of the Meteorological Reporter for Western India for 1880-81.
		Brief sketch of the meteorology of the Bombay Presidency in 1880.
	Government of Bombay	Seventh Annual Report of the Sanitary Commissioner for the Government of Bombay in 1880.
	Government Magnetical and Meteorological Observatory.	Bombay Magnetical and Meteorological Observations, 1871 to 1878.
BERLIN	Meteorological Institute	Meteorologische Beobachtungen, January 1880.
BATAVIA	Magnetical and Meteorological Observatory	Rainfall in the East Indian Archipelago, 2nd year, 1880.
		Observations made at the Magnetical and Meteorological Observatory at Batavia, Volume V, parts 1 to 5.

Presentations to the Library from the 1st April 1881 to the 31st March 1882—continued.

Place.	Donor.	Title of Work.
COPENHAGEN	Institut Météorologique Danois	Bulletin météorologique du Nord, May 1880; February to December 1881, and January 1882.
	Royal Danish Academy of Sciences	Oversigt No. 3 of 1880; 1 and 2 of 1881.
	Danske Meteorologiske Institut	Meteorologisk Aarbog for 1880, parts 1 and 3.
CARLSRUHE	Baden Meteorological Observatory	XII.—Jahresbericht der Grossherz. Badischen meteorologischen Central station Karlsruhe für das Jahr 1880; nebst mittle werthen für das Lustrum 1876—1880, und Fortsetzung des Literaturnachweises.
CALCUTTA	Government of India, Revenue and Agricultural Department	Codes of the Financial Department, Fifth Edition, 1881.
		General Report on the operations of the Survey of India during 1879-80.
		Suggestions regarding the management of the leased forests of Busáher in the Sutlej Valley of the Punjab.
		Imperial Gazetteer of India, Volumes I to IX.
		Report on the Coorg General Census of 1881, with Appendices.
		Appendix I to Famine Commissioners' Report—Miscellaneous papers bearing upon the condition of the country and people of India.
	Asiatic Society of Bengal	List of earthquakes recorded in Assam during the years 1879 and 1880.
	Marine Survey of India	General report on the operations of the Marine Survey of India for the year 1879-80.
CALCUTTA	Government of India, Home Department.	On the manufacture of iron and the future of the charcoal iron industry in India.
		Report of the Meteorological Council of the Royal Society for the year ending 31st March 1880.
		A Manual of Indian Timbers. Gamble.
	Geological Survey of India	Memoirs, Vol. XVIII, parts 1 to 3; Vol. XIX, part 1.
		Manual of the Geology of India, Vol. III.
	T. S. Gardener, Esq.	The Typhoons of the Chinese Seas in 1880.
	Surveyor General of India	General report on the operations of the Survey of India during 1879-80.
		Supplement to the catalogue of maps, plans and charts of the Survey of India, published in 1878.
	Government of Bengal	Annual Report of the Sanitary Commissioner for Bengal for 1880.
		Report on the external trade of Bengal with Nepal, Sikkim, and Bhutan, for the year 1880-81.
		Report on the internal trade of Bengal for the year 1880-81.
		Report on the Administration of Bengal for 1880-81.
	St. Xavier's College Observatory	Results of observations taken at the St. Xavier's College Observatory, January to December 1881.
		Diagrams of solar spots and protuberances recorded at the Solar Observatory, St. Xavier's College, from 1st December 1881 to 28th February 1882.
	Government of India, Military (Marine) Department.	General Report on the operations of the Marine Survey of India for the year 1880-81.
	Sanitary Commissioner with the Government of India.	Seventeenth Annual Report of the Sanitary Commissioner with the Government of India for 1880.
CORDOBA	Meteorological Office	Bericht über die geographischen ökonomischen commerziellen und politischen Verhältnisse der Argentinischen Republik; 1878 and 1879.
DEHRA DUN	E. McA. Moir, Esq.	Report of a visit to the torrent regions of the Hautes and Basses Alpes, and also to Mount Faron, Toulon.
	Great Trigonometrical Survey of India.	Great Trigonometrical Survey; Synoptical, Vol. X, Bider longitudinal series; Vol. XI Bilaspur meridional series; Vol. XII, Calcutta longitudinal series; Vol. XIII, East Coast series.
DUBLIN	Royal Dublin Society	The Scientific Proceedings of the Royal Dublin Society, Vol. II (New series), Part VII; Vol. III (New series), Parts I to IV.
		The Scientific transactions of the Royal Dublin Society, Vol. I (series II), papers Nos. XIII and XIV.

Presentations to the Library from the 1st April 1881 to the 31st March 1882—continued.

Place.	Donor.	Title of Work.
Edinburgh	Robert Tennant, F.M.S.	On the motion of a storm in an easterly direction being only possible as a circular atmospheric wave.
Gotha	Dr. E. Behen	Geographischer Monatsbericht.
Goa	Meteorological Observatory	Observacões meteorologicas de Goa; 2nd Semestre do Anno de 1880.
Greenwich	Royal Observatory	Greenwich magnetical and meteorological observations for 1879.
Guatemala	Instituto Nacional de Guatemala	Meteorological Observations, October 1879; March to May, September to December and résumé 1880; January to April 1881.
Hamburgh	Duetsche Seewarte	Monatliche Uebersicht der Witterung, May to December and year 1879; September to December, and year 1880; January to September 1881.
		Wetterbericht, Band VI, Nos. 60-118, 120-131, 133-365; Band VII, Nos. 1 to 31.
		Aus dem Archiv der Deutschen Seewarte; II Jahrgang 1879; Jahrg. III, 1880.
	Dr. A. Sprung	Uber das Hadley'sche Prinzip.
Havanna	Real Collegio de Belen	Observaciones magneticas y meteorologicas, Año de 1874.
Hongkong	Government of Hongkong	Meteorological Observations taken at Hongkong during December 1880, January to March, and July to December 1881; January 1882.
Hyderabad	Resident at Hyderabad	Report on the Administration of the Hyderabad Assigned Districts for the year 1879-80.
Iowa	Iowa Weather Service	Iowa Weather bulletin, January to November 1881.
		Report for 1881.
		Iowa Weather Report for 1879, 2nd and 3rd quarterly numbers, and 1881 1st quarterly number.
London	Meteorological Office	Weekly Weather Report, Vol. IV, Nos. 8 to 52; Vol. V, Nos. 1 to 7.
		Hourly readings from the self-recording instruments at the seven observatories, January to September 1880.
		Report of the International Meteorological Committee meeting at Berne, 1880.
		Daily Weather Reports from 1st July to 31st December 1880.
		Quarterly Weather Report (New series), part I, January to March 1876.
	G. M. Whipple Esq., B. Sc.	Results of experiments made at the Kew Observatory, with Bogen's and George's barometer.
		Variations of relative humidity and thermometric dryness of the air, with changes of barometric pressure at the Kew Observatory.
		Relative frequency of given heights of the barometric readings at the Kew Observatory, on Mr. Eaton's table of barometric heights at London, with regard to periodicity.
	Institution of Civil Engineers	Abstracts of papers in foreign transactions and periodicals, Vol. LIX, Session 1879-80, part I; Vol. LXVI, Session 1880-81, part 4.
	Society of Arts	Journal, Nos. 1476 to 1528.
	G. J. Symons, Esq.	Symons's Monthly Meteorological Magazine, March, May to October, and December 1881; January and February 1882.
	The Publishers of the 'Colonies, &c.'	The Colonies and India, Nos. 448, 449, 458, 463, 465, 468, 480.
	Royal Society	Proceedings, Vol. XXXI, Nos. 207 to 211; Vol. XXXII, Nos. 212 to 215.
	Meteorological Society	Quarterly Journal, New series, Vol. VII, Nos. 37 to 40.
		The History of the English Meteorological Societies, 1823 to 1880.
		List of Fellows of the Meteorological Society, January 19th, 1881.
		The snow-storms of January 17th to 21st, 1881.
		The Meteorological record, Nos. 1—3 of 1881.
		Hints to Meteorological Observers, with instructions for taking observations, and tables for their reduction.
		Index to the publications of the English Meteorological Societies, 1839-1881.

Presentations to the Library from the 1st April 1881 to the 31st March 1882—continued.

Place.	Donor.	Title of Work.
LONDON—*contd.*	Royal Asiatic Society	Journal, Vol. XIII, parts II, III, IV.
	Kew Committee of the Royal Society	Report of the Kew Committee for the year ending 31st October 1881.
	E. J. Mills, D.Sc., F.R.S.	Researches in thermometry.
LEIPZIG	Meteorological Observatory	Bericht über das meteorologische Bureau für das Jahr, 1880.
		Die Ergebnisse der Niederschlags-Beobachtungen in Leipzig und an einigen anderen Sächsischen Stationen, 1864-1881.
LISBON	Royal Academy of Sciences	Historia dos Estabelecimentos Scientificas Literarias, Artisticas, Tomo VIII and IX.
		Jornal de sciences, mathematicas, physicas e naturaes, Nos. XXIV to XXIX.
		Memorias da Academia, classe de sciences, mathematicas, physicas e naturaes Nova Serie, Tomo V, parts I and II; Tomo VI, part I.
		Sessão Publica da Academia real das Sciencias de Lisboa em 9 de Junho de 1880.
MUNICH	Professor Dr. Carl Arendts	Deutsche Rundschau für Geographie und Statistic, Vol. III, Nos. 7 to 12; Vol. IV, Nos. 1 to 6.
	Baron Hermann von Schlagintweit-Sakünlunski.	Die Regenverhältnisse in Indien, nebst dem indischen Archipel, und in Hochasien, Theil I, Erlaüterung der Untersuchungen. Die Beobachtungen in Nordlichen Indien von Ost gegen West and Theil II, Reihe A. Die Beobachtungen in centralen und in südlichen Indien. Reihe B. Die Beobachtungen in Ceylon, in Hinter Indien und im Archipel.
	K. Sternwarte	Meteorologische und Magnetische Beobachtungen; Jahrgänge, 1880 and 1881.
	Royal Academy of Sciences	Abhandlungen der mathematisch-physikalischen Classe, Band XIV, Abth I.
		Sitzungsberichte der mathematisch-physikalischen Classe, Band XIV, Abth I, Hefte 1 to 3 of 1881.
MANCHESTER	D. Winstanley, F.R.A.S.	Description of the Radiograph.
MEUDON (PARIS)	Observatoire de Meudon	Annuaire pour l'an 1882.
MEXICO	Central Meteorological Observatory.	Boletin, Tomo VI, Nos. 7 to 100 and 107 to 152.
		Revista Mensual Climatologica, Tomo 1, Nos. 1 to 3 and 5 to 9.
		Revista Cientifica Mexicana, Tomo I, Nos. 13 and 15 to 17.
		Anales del Ministerio de fomento de la republica Mexicana, Tomo IV and V.
MONTSOURIS (PARIS)	Observatoire de Montsouris	Annuaire for 1882.
MORADABAD	Rev. G. T. Carruthers	A Theory concerning Sun-spots.
MELBOURNE	Meteorological Observatory	Monthly Record of results of observations in Meteorology, Terrestrial Magnetism, &c., taken at the Melbourne Observatory from September to December 1880, and in January and February 1881.
MAURITIUS	Royal Alfred Observatory	Mauritius Meteorological results for 1877 to 1880.
		Annual Report of the Mauritius Observatory for 1880.
NEW YORK	Meteorological Observatory	Abstract of registers from self-recording instruments for December and annual tables for 1880, and for January to November 1881.
PARIS	Bureau Central Météorologique de France.	Bulletin International, Vol. XXV, Nos. 49 to 237, 239 to 267, 269 to 271, 273 to 365; Vol. XXVI, Nos. 1 to 47.
		Supplement, Nos. 90, 151, 181, 212, 245, 273, 304, 334 and 363.
		Annales 1878; Tomes II and IV; 1879, Tomes I and IV.
	Société Météorologique de France	Annuaire, 28me Année, 1880, 3me Tremestre; 29me Annee, 1880 1er Tremestre.
	J. G. Détlmeida	Journal de Physique, théorique et appliqué.
PHILADELPHIA	Franklin Institute	Journal, 3rd series, Vol. CXI, No. 3 and Supplement and Nos. 4 to 6; Vol. CXII, Nos. 1 to 5; Vol. CXIII, No. 1, Vol. CIX, No. 4; Vol. CX, No. 3.
PRAGUE	Imperial Observatory	Astronomische magnetische und meteorologische Beobachtungen im Jahre 1880.
PERTH (WESTERN AUSTRALIA).	Survey Department, Meteorological Branch.	Western Australia, Meteorological Report for 1880.

Presentations to the Library from the 1st April 1881 to the 31st March 1882.—continued.

Place.	Donor.	Title of Work.
Rio de Janeiro	Imperial Observatory	Notice súr l'observatoire impérial de Rio de Janeiro à propos de l'erection du nouvel observatoire Royal de Belgique.
		Bulletin, July and August 1881.
St. Louis	Washington University	Missouri Weather Service, March, May and July 1880, and February and April 1881.
		The Tornado of April 14, 1879.
		Report on the Magnetic observations in Missouri, Summer of 1879 and 1880.
		Thoughts on our conception of physical law.
Syracuse	Observatorio Centrale di Siracusa.	Osservazioni meteorologiche, Anno V, Nos. 1 to 12.
Sydney	Meteorological Office	Results of Meteorological observations made in New South Wales, from 1876 to 1879.
		Weather maps, 1877, 1878, complete; January to June 1879.
		Results of rain and river observations made in New South Wales during 1880.
		Thunder and hailstorms in New South Wales.
		Recent changes in the surface of Jupiter.
		Results of Astronomical observations made at the Sydney Observatory in 1877 and 1878.
	H. C. Russel, B.A., F.R.A.S.	Papers read before the Astronomical section of the Royal Society of New South Wales, in 1878 and 1879.
		The Wentworth Hurricane.
		The Gem cluster in Argo.
		Some new double stars and southern binaries.
		Note upon a sliding scale for correcting barometric readings to 32° and near Sea-level.
Simla	Inspector-General of Forests with the Government of India.	Review of the Forest Administration in the several provinces under the Government of India for the year 1879-80.
	The Hon'ble Whitley Stokes	Transactions of the Royal Irish Academy, Vols. XIX, XXIII and XXV, parts 2 to 8.
St. Petersburgh	Physical Central Observatory	Die Temperature-Verhältnisse des Russischen Reiches, von H. Wild. Supplement Band zum Repertorium für Meteorologie; zweite Hälfte nebst Atlas.
		Annales de l'observatoire Physique Central, Nos. 1 and 2 of 1879.
	A. J. Woeikof	Gletscher und Eiszeiten in ihrem Verhältnisse zum Klima.
		Études sur l'amplitude diurne de la témpérature, et sur l'influence qu'exerce sur elle la position topographique.
	International Polar Commission	Rapport sur les Actes et résultats de la troisiéme Conference polaire Internationale tenue a St. Petersburgh, pendant les jours du 1er au 6 Août 1881.
		Communications from the International Polar Commission, part I.
Stockholm	Royal Academy of Sciences	Sur la variation diurne de la force du vent par H. E. Hamburgh, parts I and II.
Toronto	Hugh V. Payne, Esq.	A storm sailing guide for the North Atlantic.
	Meteorological Office	Monthly Weather Review, February to December 1881, January 1882, and general Meteorological Register for 1881.
		Report of the Meteorological Service of the Dominion of Canada for the year ending 31st December 1879.
Tokei (Japan)	Imperial Meteorological Observatory.	Meteorological observations recorded at Wakayama, May to December and year 1880, and January to May 1881.
		Meteorological observations recorded at Hiroshima, April to December and year 1880, and January to September 1881.
		Meteorological observations recorded at Niigata, July to September 1881.
		Meteorological observations recorded at Nangasaki March to December and year 1880, and January to September 1881.

Presentations to the Library from the 1st April 1881 to the 31st March 1882—continued.

Place.	Donor.	Title of Work.
TOKEI (Japan)	Imperial Meteorological Observatory.	Meteorological observations recorded at Kioto, October to December 1880, and January to September 1881.
		Meteorological observations recorded at Tokei, July to December and year 1880, and March to October 1881.
		Meteorological observations recorded at Tokei (weekly), 20th July to 31st December 1880.
		Results of the Meteorological observations recorded at Tokei for the lustrum 1876-80.
		Comparison of the results of observations made at the several Meteorological stations in Japan for the year 1880.
		Meteorological observations recorded at the several stations in Japan during the Typhoons of 13th-14th, and 26th-27th September 1881.
TIFLIS	Physical Observatory	Beobachtungen der Temperatur des Erdbodens im Jahre 1880.
		Meteorologische Beobachtungen im Jahre 1880.
TURIN	Osservatorio Astronomico di Torino.	Effemeridi del sole della luna e dei principali Pianeti calcolate per Torino in tempo-medio civile di Roma, anno 1882.
		Bollettino de l'osservatorio della regia Universita di Torino, parte Meteorologica, Anno XV (1880).
UTRECHT	K. Nederlandsch Meteorologisch Institut.	Jaarboek 1876.
UPSALA	Dr. Hildebrand Hildebrandsson	Bulletin mensuel de l'observatoire météorologique de l'université d'Upsal Volume XIII, Année 1880.
	Meteorological Observatory	Observations météorologiques faites par l'éxpédition de la Vega du cap Nord à Yokohama par le detroit de Behring.
VIENNA	Dr. J. Hann	Zeitschrift der Oesterr. Meteor. Gesellschaft, Band XVI, March to December 1881; Band XVII, January and February 1882.
	K. K. Meteorologischen, Central Observatorium.	Wetterhericht, Vol. V, Nos. 86 to 365 and Vol. VI, Nos. 1 to 35.
	K. K. Geologischen Reichsanstalt	Verhandlungen, Nos. 12—18 of 1880, with title page, and Nos. 1-4 and 6-7 of 1881.
	K. K. Central Anstalt für Meteorologie und Erdmagnetismus.	Jahrbuch; neue Folge XVII, Jahrgang 1880, Erster Theil.
	Royal Academy of Sciences	*Bregina.*—Über die Meteoreisen von Bolson de Mapimi. Bericht über neue oder wenig bekannte Meteoriten; III.
		Ditscheiner.—Über die Aufsuchung der Störungsstellen an nicht vollkommen, isolirten Leitungen.
		Exner.—Die Theorie des Galvanischen Elementes. Zur Frage nach der Natur der Galvanischen Polarisation. Über Galvanische Elemente, die nur aus Grundstoffen bestehen; und über das elektrische Leitungsvermögen von Brom und Jod.
		Hann.—Die vertheilung des Regenfalls über Österreich in der Periode vom 11-15 August 1880, und deren Beziehung zur Vertheilung des Luftdruckes. Über den täglichen Gang einiger Meteorologischen Elemente in Wien (Stadt). Über den täglichen Gang des Luftdruckes, der Temperatur, der Feuchtigkeit, Bewölkung und Windstärke auf den Plateaux der Rocky Mountains.
		Hepperger.—Über den Einfluss der Concentration der Flüssigkeiten auf die elektromotorische Kraft des Daniell'schen Elementes.
		Hochstetter.—Ergebnisse der Höhlenforschungen in Jahre 1879.
		Prähistorische Ansiedelungen und Begrabnisstätten in Niederösterreich und in Krain.
		Hornstein.—Beitrag zur Kenntniss des Asteroidensystems.
		Horteweg und Julius.—Über das Grössenverhältniss der elektrischen Ausdehnung bei Glas und Kautschuk.
		Liznar.—Über die Beziehung der täglichen und jährlichen Schwankung der Temperatur zur eilfjährigen Sonnenfleckenperiode.
		e r—Über die Bahn des Kometen 1880 b.
		Niessl.—Theoretische Untersuchungen über die Verschiebungen der Radiationspunkte auf gelöster Meteorströme.

Presentations to the Library from the 1st April 1881 to the 31st March 1882—continued.

Place.	Donor.	Title of Work.
VIENNA	Royal Academy of Sciences	*Pernter.*—Über den täglichen und jährlichen Gang des Luftdruckes auf Berggipfeln und in Gebirgsthälern.
		Puluj.—Strahlende Elektrodenmaterie.
		Puschl.—Über die latente Wärme der Dämpfe.
		Reitlinger und Wächter.—Über Disgregation der Elektroden durch positive Elektricität und die Erklärung der Lichtenberg'schen Figuren.
		Schuhmeister.—Bestimmung magnetischer und diamagnetischer Constanten von Flüssigkeiten und Gasen in absolutem Masse.
		Stefan.—Über einige Versuche mit einem erdmagnetischen Inductor.
		Über das Gleichgewicht eines festen elastischen Körpers von ungleichförmiger oder veränderlicher Temperatur.
		Über die Verdämpfung aus einem Kreisörmig oder elliptisch begrenzten Becken.
		Tinter.—Zur Bestimmung der Polhöhe auf dem Observatorium der K. K. technischen Hochschule in Wien.
		Weiss.—Über die Berechnung der differential Quotienten der währen Anomalie und des Radius vector, nach der Excentricität in stark excentrischen Bahnen.
		Anzeiger.—Nos. 20-28 of 1880 and Nos. 1 to 19 of 1881.
VIZAGAPATAM	A. V. Nursingrow, Esq., F.R.A.S., F.R.G.S.	Results of meteorological observations taken at G. V. Juggarow Observatory, Vizagapatam, during 1880.
WELLINGTON	Meteorological Office	Abstract of meteorological observations in New Zealand; November and December 1880, and for quarters ending March, June, and September 1881.
		Meteorological Report for 1880.
		Statistics of the Colony of New Zealand for the year 1880, Meteorology.
WASHINGTON	United States Coast and Geodetic Survey.	Report of the Superintendent, Meteorological researches; Part II, on Cyclones, Tornadoes and Waterspouts.
	Chief Signal Office	Bulletin of international meteorological observations, 4th May to 24th July 1880.
		Monthly Weather Review, February to September 1881.
		United States Polar instructions.
		Report of the chief signal officer for 1879.
		Daily bulletin of weather reports, &c., June to August 1877.
	Smithsonian Institution	Smithsonian Report for 1879.
		On the Cyclones of January 1st to 4th, 1873.
	United States Naval Observatory	Meteorological observations made at the United States Naval Observatory during 1877.
		Reports of the total solar eclipses of July 29, 1878, and of January 11, 1880.
	Prof. Cleveland Abbe	Physics of the globe.
ZURICH	Swiss Meteorological Institute	Meteorologische Beobachtungen für 1878 and 1880, pp. 229-240.
		Ditto ditto an 16 stationen der Schweiz, January to December 1881.
	Francois W. C. Trafford	Souvenir de l'amphiorama on la vue du monde pendant son passage dans une comête.
ZI-KA-WEI	Magnetical and Meteorological Observatory.	Bulletin mensuel; December and year 1880, and January to August and October to December 1881, and year.
		The Typhoons of the Chinese Seas in the year 1880.
		Sur l'inclinasion des vents; nouvelle gironette pour observer cette inclinaison.

Purchases for the Library.

American Journal of Science and Arts, Vol. XXI, Nos. 123-126; Vol. XXII, 127 to 132.

Annalen der Physik und Chemie, Nos. 3 to 12 of 1881 and Nos. 1 and 2 of 1882.

Comptes Rendus de l' Academie de Sciences Vol. LXXXVIII, Nos. 14 and 15; Vol. XCII, Nos. 9 to 26; Vol. XCIII, Nos. 1 to 26; Vol. XCIV, Nos. 1 to 8, Index of Vol. XCI and Tables des Comptes Rendus.

Chambers' Mathematical Tables.

Deschanel's Natural Philosophy, by Professor Everett.

Encyclopædia Britannica, Ninth Edition, Volumes I to IX.

La Nature, Nos. 406 to 457.

Lightning Conductors, their history, nature and mode of application, by Richard Anderson.

Nature, Nos. 593 to 636 and 639 to 644; title page and contents of Vol. XXIV and Binding covers of Volumes 15, and 17 to 24.

Philosophical Magazine, New series, Vol. XI, Nos. 68 to 71; Vol. XII, Nos. 72 to 79.

Report of the British Association for the advancement of Science for 1880.

Theory of Heat, by J. C. Maxwell.

Units and Physical Constants, by Professor Everett.

Government of India Central Printing Office—No. 81, Meteor—2-11-82.—400.

REPORT

ON

THE ADMINISTRATION

OF THE

METEOROLOGICAL DEPARTMENT OF THE GOVERNMENT OF INDIA

IN

1882-83.

THE year, to be dealt with in the present report, is the eighth that has elapsed since the re-organisation of the system of meteorological observations in India. It was foreseen, at the outset, that as, on the one hand, systematic observation should lead up to definite lines of enquiry, and, on the other hand, the demand for prompt and trustworthy information should increase with the growth of public interest in the current weather statistics of the country, so the work of the Department would necessarily expand both on its collecting and distributing sides; and, as this and previous reports will show, this expectation has been fully justified by the event. The area of observation which, in 1875, comprehended little more than the provinces under the principal Local Governments of India proper, some of which, moreover, were very imperfectly represented, now extends to the Native States both in India and around its borders, to the shores of Africa and the Persian Gulf, and comprises also all accessible parts of the Burmese peninsula; and, through Mr. Eliot's exertions, it has lately been extended, on an experimental scale, to the waters of the Bay of Bengal; while a beginning has been made to reduce and collate the mass of observations of past years, relating to Indian seas, which have accumulated in the London Meteorological Office, and to obtain therefrom the facts of the normal meteorological conditions of these seas, so indispensable to the explanation of those of the land area.

On the other hand, a considerable development has been given to the daily and other periodical reports, which are not only more numerous and comprehensive, but also more widely circulated than in previous years; while the descriptive portion of the daily reports is communicated daily by telegraph to all the principal seats of Government. Periodical summaries of the weather are now issued in anticipation of the detailed annual report, which forms its permanent record. And, in Bengal, preparations were in progress, at the cost of the Local Government, to establish a provincial system of daily telegraphic report, to be administered by the local Reporter; the object of which is to furnish the

Government with more prompt and detailed information than that yielded by the weather bulletins of the Imperial Government. This system has been brought into operation since the close of the year.

The arrangement of the present report will be similar to that of its predecessors of the last two years. The first part will notice the more important topics which have received attention during the past year; and the second part will recount the details of the administration. The several provincial reports are given in the Appendices.

SOLAR PHYSICS.—The report of the Committee on Solar Physics, appointed by the Lords of the Committee of Council on Education, which has been recently issued, shows that Indian observers have made considerable contributions to many of those subjects which have engaged the attention of the Committee. Previously to the appointment of the Committee in 1879, the connexion between solar phenomena and those of terrestrial magnetism had been made the subject of discussion by the late Mr. J. Allan Broun and Mr. Charles Chambers. And the relations of meteorological phenomena, more especially of barometric pressure and rainfall, to the variations of the solar surface, had been investigated by the same writers, and also by Messrs. Archibald, F. Chambers, Eliot, Hill, Hunter, and myself. Moreover, with respect to the direct registration of solar phenomena, a correspondence with the India Office in 1877, had led to the despatch of Mr. Meins as solar photographer to India in that year; and furnished with a photo-heliograph, similar to that employed at Kew, which is adapted to take pictures of the solar disk 4 inches in diameter, Mr. Meins was employed, at Dehra, under the direction of the Surveyor General, in taking daily photographs of the sun, up to the date of his death in March 1879. After this sad event, an interval of nearly nine months elapsed, during which the work was interrupted; but the experience, already gained, having demonstrated the very great advantages, presented by India, for obtaining photographic records of the solar surface,[1] Sergeant White, of the Royal Engineers' Corps, was sent out at the close of 1879, and he has since carried on the work under the superintendence of Mr. J. B. N. Hennessey, M.A., F.R.S., Deputy Superintendent of the Survey of India. A large photo-heliograph, suitable for taking pictures of the solar disk 12 inches in diameter, has since been supplied to the Dehra observatory; and some additions have been made to the smaller instrument, rendering it capable of taking pictures 8 inches in diameter.

The detailed reports on these photographic operations are given in the Annual Reports of the Surveyor General; and they are referred to here, only as being closely connected with work, in which the Meteorological Department has also borne its share. The question with which meteorology is immediately and profoundly concerned, is that of the variations of the radiant energy of the sun. The observation of the maximum temperature, shown by a thermometer, with the bulb coated with lamp black and enclosed in an exhausted tube, when exposed to the sun, has, from the beginning, been a part of the daily work at all Indian observatories. But this, at best, affords but a very rough indication of the local intensity of the sun's rays; and it is still a question whether, by any precautions, it can be made to serve as a measure of the original radiant energy of the sun. Such attempts as I have made to utilise the observations, for this purpose, in 1875, and again during the past year,[2] have resulted in a very partial and somewhat dubious success; and a subsequent discussion of a portion of the data, by Mr. Hill, led to conclusions consistent in themselves, but apparently conflicting with those obtained by other methods.

---

[1] According to the return given in the report, out of 384 days in India, only 42 yielded no photograph; whereas at Greenwich, out of 387 days not less than 244 were blank days.

[2] Journal of the Asiatic Society of Bengal, Vol. LI, Part 2, p. 72, 1882.

It is then to more efficient instruments, such as the actinometer invented by Professor Balfour Stewart, that we look for more trustworthy information. Regular observations, with an instrument of this kind, were commenced in the latter part of 1879 at the Alipore Observatory, Calcutta; and after some tentative variations of method, a system of observation was begun in April 1880, which, with but slight modification, has been continued up to the 15th February 1883, when it became necessary to stop the work, in order to meet the requirements of the more important operations about to be undertaken at Leh in Ladakh.

Two years' results of the Alipore observations, after reduction, have been sent home to the Solar Physics Committee, and those of the first year have been published as an Appendix to the Committee's report. The second year's series, April 1881 to March 1882, taken on clear days only, show a slight increase in the intensity of the solar heat, as compared with those of clear days in 1880-81; an increase, which Professor G. G. Stokes considers to be too systematic to be the result of accidental circumstances. But the experience gained shows that the atmosphere of Calcutta is but ill-fitted for observations of such delicacy; and although I regret that circumstances have obliged me to bring them to a close, it is not possible to cherish the idea that they could ever be of high value, as indicating variations in the solar intensity.

I have now to recount the steps that have been taken to establish an actinometric observatory in the more promising atmosphere of Western Tibet, at an elevation of 11,500 feet above the sea. In a report by Professor G. G. Stokes, Professor Balfour Stewart, and General Strachey, presented to the Lords of the Committee of Council on Education in December 1877, the suitability of Leh, for observations of this class, was pointed out; and it was suggested that a sapper, trained in the use of the instruments, should be sent to India to carry out the work. The advantages to be gained by the selection of a station in a notoriously dry climate, with a clear atmosphere[1] and freed from the heat absorption of 11,500 feet of the lowest and densest part of the atmosphere, are sufficiently obvious, when it is considered that the variability of the atmospheric absorption and of its opacity to the sun's rays, is the one great obstacle to the measurement of the solar heat. And indeed direct proof of the supreme advantages for actinometric work, presented by a mountain station in a dry climate, has been recently obtained by Professor

[1] The clearness of the atmosphere from dust haze has been called in question by M. de Nicéville in some remarks printed in the Proceedings of the Asiatic Society of Bengal for February 1883; but the report adds that, while this dust haze is particularly remarkable in the valleys about Leh, an ascent of a few hundred feet carried one quite clear of it. This fact is confirmed by the evidence of Dr. Cayley, who resided at Leh during the greater portion of the year, for four years, and whose opinions are quoted by General J. T. Walker in a letter printed as Appendix E to the Solar Physics Committee's Report, in the following terms—"I believe, from much experience of the climate, that few better places in the world can be found than Leh, for any sun observation. The number of cloudy days in the year is very small. One may say that from early April to October there are almost none. The air is perfectly dry and free from moisture, and without vapour of any kind. There is not, on an average, above 2 inches of rain. During the five winter months, there is more cloud and some snow, but still comparatively little; nothing like the more southern Himalayas; and there is far more of clear than cloudy weather.

"As to dust, there is often a good deal of dust and sand blowing up in the valley of the Indus, below Leh, in the windy part of the afternoon; but it is very partial and never obscures the sky; and at Leh itself, which is between 4 and 5 miles up a side valley, and is surrounded by cultivated and irrigated fields, there is no dust at all; the air is always perfectly transparent, so that the most distant mountain peaks are as sharply defined as if they were close at hand."

Langley in Colorado, whose observations may be said to have revolutionised the views previously held as to the extent and distribution of energy in the solar spectrum.

Accordingly, in the report which I addressed to Government on the 8th June 1881, I recommended the adoption of the suggestion put forward in the report above quoted, and this recommendation having been approved and sanctioned by Government, (Proceedings, Department of Revenue and Agriculture, of the 27th October 1881), the Right Honourable the Secretary of State was moved to obtain the services of a trained observer, through the assistance of the Solar Physics Committee. As the results of these measures, Sergeant Rowland, a non-commissioned officer of the Corps of Royal Engineers, was instructed in the use of the actinometer at Kew Observatory, and provided with a passage to Bombay, where he arrived on the 31st October 1882.

As he arrived too late in the season to allow of his proceeding to Leh before the closing of the passes, I placed his services at the disposal of Mr. J. B. N. Hennessey, who was engaged in actinometric observations at Mussooree, and who very kindly undertook to employ him on the work, to train him in the use of meteorological instruments, and also to superintend the verification of the actinometers which Sergeant Rowland was to take with him to Leh. An assistant having also been sanctioned to accompany Sergeant Rowland, Mr. Hennessey further undertook to select and train a European youth, Mr. H. G. Shaw, who has been appointed after undergoing satisfactory probation.

I have lately heard from Mr. Ney Elias, at Leh, that quarters are prepared for Sergeant Rowland and the assistant; and they are now only delayed for the verification of a further supply of instruments, to replace the breakages that have almost annihilated the stock originally supplied for their work. These arrived at the end of May, and as soon as their verification is complete, the observers will start on their journey.

The enforced retention of Sergeant Rowland and Mr. Shaw at Mussooree and Dehra is by no means to be regretted. In a letter recently received from Mr. Hennessey, he writes—" Sergeant Rowland is going on working regularly, receiving a thorough training and acquiring delicacy of touch and keenness in observing the aspect of the sky, without which his results would have been useless. He could have sent home, anyhow, a large mass of readings, no doubt; but they would have been misleading and useless. I am sure it needs a highly trained, expert and keen observer to make out anything trustworthy of solar radiation."

A further reason for doubting whether any useful results could have been obtained by Sergeant Rowland, had he at once departed for Leh, on his arrival in India, is that the thermometers sent out for use with his actinometer, on the integrity of which his work was dependent, have proved, on trial, in great part a failure. Of the six instruments, one arrived cracked, and three others have since broken without assignable cause, owing probably to bad annealing. And as the remaining two have been accidentally destroyed, he would probably have been left without the means of observing. The supply ordered to replace these, which has just arrived, are by Messrs. Casella, whose instruments, previously supplied, have proved excellent. A report on the failure of those by the other maker has been sent to the Indian Store Department.

In conclusion, I desire to express my great indebtedness to Mr. Hennessey for his assiduous exertions to ensure the success of Sergeant Rowland's mission.

SNOWFALL REPORTS.—A department of observation, the importance of which, in connection with Indian meteorology, was, as far as I am aware, hardly suspected before

1875, (when, for the first time, the weather phenomena of the whole country were brought together, and investigated as a systematic whole), but which the experience of each additional year has tended more and more to bring into prominence, is that of the condition, extent, and persistence of the Himalayan snow-fields. When we consider how great is the contrast in the behaviour of a snow sheet, and a bare rock surface, and how differently they affect the superincumbent atmosphere, when equally exposed to the ardent radiation of a sub-tropical sun; and when, therewith, we note the fact, that on the northern limits of India, there is an area many thousands of square miles in extent, around the permanent *nevée* and glaciers, which alternates between these two conditions, accordingly as the winter and spring snowfall is copious or scanty, the idea that these differences must exert a potent influence on the meteorology of the plains is sufficiently obvious. But, as a fact, it was not until, in writing the report on the meteorology of the Madras famine year (1876), my attention was forcibly drawn to the unusual persistence of dry north-west winds in North-Western and Western India, and that, in the course of the discussion, a connection was traced between these winds and the anomalously high pressure and low temperature of the North-West Himalaya and the Upper Punjab,[1] that their probable dependence on the late and copious snowfall of the spring of that year, was first definitely suggested to my mind. From that time, as far as information has been forthcoming, the subject has been kept steadily in view. The winters of 1876-77 and of 1877-78 were characterised by heavy falls of snow, and in a still more marked degree,[2] in the latter season, more especially in Kashmir and Western Tibet; and in 1877, the summer monsoon was unusually weak and the rains failed almost entirely in North-Western India;[3] while in 1878, they were greatly retarded, and throughout the Gangetic plain and in Central India very deficient.[4] These three years affording positive evidence of the coincidence of a copious and late snowfall with deficient and retarded monsoon rains, were followed by a remarkably dry and snowless winter and spring in 1878-79; and, save in some parts of the Punjab and Bengal, abundant monsoon rains in the latter year.[5] The year 1880, which succeeded, afforded two instances of somewhat remarkable evidence bearing on the matter in hand. In the first place, a copious, but not very prolonged, fall of snow on the Himalayas in February, accompanied with cloudy weather, rain, and unusual cold throughout Northern India, was the immediate forerunner of three remarkably hot and dry months. But at the end of June and in July there was some very heavy rain on the North-West Himalaya, and, what is very unusual at this season, a copious fall of snow on the higher ranges, of which reports were received from residents in Kashmir and Lahoul. The month of August, which followed, to quote the words of the report on the meteorology of that year, "was in the latter half almost rainless, in the greater part of Northern India, and dry westerly winds set in, which recalled, for the time, the disastrous seasons of 1876 and 1877 and seemed to justify the most gloomy forebodings."[6] The winter of 1880-81 again was one of light snowfall. A moderate fall took place in March, up to which there had been scarcely any; and April and May were dry and seasonable, characterised by hot land winds of somewhat more than usual steadiness.

---

[1] Rep. cit. page 96.

[2] Report on the Meteorology of India in 1876, p. 97; Ditto of 1877, pp. 158 and 171; Ditto of 1878, pp. 147, 148.

[3] Ditto ditto in 1877, pp. 138 seq. 159.

[4] Ditto ditto in 1878, pp. 135, 137, 141, 149.

[5] Ditto ditto in 1879.

[6] Ditto ditto in 1880, p. 151.

The rains set in and also came to an end somewhat earlier than usual, but the rainfall, with merely local exceptions, was well up to the average, and in most parts of Northern India somewhat above it.

The meteorological history of 1882 has yet to be written; but as far as general experience admits of an opinion, it afforded no evidence adverse to the conclusion, to the soundness of which the previous years testify in so striking a manner.

Thus it appears that, since attention was first directed to the subject in 1876 and 1877, experience has uniformly confirmed the justice of the view put forward tentatively in the report on the meteorology of the former of these years. And therefore it becomes a matter of very high importance in the practical application of our meteorological system to the framing of forecasts of the rainy season, that very special steps be taken to obtain the fullest possible information on the extent and thickness of the snows; and more especially on their condition in the spring months, the period during which their slow or rapid decrease is of more immediate importance to the prospects of the ensuing rains. Some steps have already been taken to this end. Since 1880, an annual report has been regularly received from the Commissioner of Kumaon, General Sir H. Ramsay, on the snowfall of the outer Himalaya; and occasional information of much value has been contributed by the British Joint Commissioner of Leh, Mr. Ney Elias, by the Deputy Commissioner of Chamba, Major Marshall, Sir O. St. John, and some other officers. Quite recently, *viz.*, in April 1882, a further communication was made by the Government of India to the Local Governments of the Northern Provinces, requesting that the attention of the civil officers and residents of Hill States might be particularly directed to this matter; and it was recommended that monthly reports on the state of the snows, on the passes and the higher ranges of the interior, should be drawn up from information to be obtained from native traders and travellers and others, and communicated to this office. But in order that these reports should receive that attention which the importance of the subject seems to demand, it is necessary that civil officers and others who are in a position to obtain and contribute this information, should be made aware of the objects which it is required to subserve, and that they should understand how and in what manner the snow-fields are conceived to influence the rainfall of the plains. Only thus will they become impressed with a full sense of the great administrative importance of the information required of them; and they will be led to obtain and forward information from the less accessible parts of the mountain tract, with the requisite fulness and frequency. And I would recommend therefore, that this and the next following sections of this report be embodied in a special circular; to be disseminated as fully as possible to all officers resident in the interior of the hills, of whatever rank or status, who may be in a position to obtain the required information.

THEORY OF DRY WINDS AND DROUGHT IN INDIA.—The observed facts are that a fall of snow on the hills is followed, as soon as the weather clears, by a considerable rise of pressure over the mountains, and frequently also over the north-western plains; and this rise is accompanied by a steady wind on the plains, from north along the foot of the hills; from north-west on the more distant plains. In the cold weather and early spring, when there is often rain simultaneously on the plains, there is also a considerable fall of temperature; but in April frequently, and generally in May, there is no rain on the plains, and any fall of temperature is restricted to the immediate neighbourhood of the hills. In these months, the cooling effect of the snows is local, but it is also persistent ; and since the snow reflects a large portion of the sun's rays, and that which is absorbed does not raise the temperature of the surface, nor that of the air resting on it, above the freezing point, this air remains denser and heavier than it would be over a bare rock surface. It flows away as a north-west wind, at a high level, towards the plains, communicating its high pressure and southward movement to the lower strata ; and thus the whole mass of dry air moves towards the region of low pressure, (which then exists over the plains of Behar, Bengal, and the peninsula), constituting the dry land winds, usually characteristic of the spring, and in seasons of unusual snowfall lasting into the summer months. These winds are hot, the heat being absorbed from the dry. strongly heated land surface ; and the lower strata, thus heated, mingle by convection with the higher ; while the latter, descending, are also heated, partly by the compression which the air necessarily undergoes, partly by being brought within the heating influence ofhe gtround.

Such appears to be the theoretical explanation of the dry winds of North-Western and Western India. The distance to which they prevail depends, in part, probably, on foreign circumstances, especially on the relation of pressure between the sea and the land. And thus, as in 1876, they may extend far down the west of the peninsula, or, as in 1877, they may be chiefly restricted to Northern India. But wherever they prevail, they keep back the damp wind from the sea, and are the cause of drought, and when unduly and unseasonably prolonged, it may be of famine in the land.

Even when most persistent, they may not prevail absolutely without intermission, for, as Mr. Herbert Spencer has pointed out, all continued action against resistance tends to become intermittent and oscillatory ; but they predominate in proportion to the strength of the operative cause that produces them.

The above views have been arrived at by a gradual process of induction from the observations accumulated during the last eight years ; and the partial generalisations which have led up to them, and much of the evidence on which they rest, may be found in the pages of the Annual Reports and other publications of the Department. It now remains to verify, perhaps in some respects to modify and correct them. As representing the determining causes of famine, they are certainly far from exhaustive ; for in periods of severe and prolonged drought, such as the two years, August 1876 to August 1878, there were causes in operation, of far wider incidence than any which have their seat in the Himalaya. But even as throwing a partial light on the cause of drought, the theory appears to me to have such claim to consideration, as to make more special study of Himalayan meteorology a matter of considerable moment.

HIMALAYAN METEOROLOGY.—From what has been said in the preceding paragraph, it follows that the more special study of the meteorology, or, more definitely, the atmospheric physics of the mountain tract, promises to become of peculiar importance, in relation to the rainfall of the plains. We have, at present, nine observatories in the Himalaya, and there will shortly be ten, all but two being in the outer ranges. The registers, afforded by these, are fairly satisfactory ; in one or two cases, equal to the best yielded by observatories of their class. But they are, of necessity, situated at the hill stations, and the registers of wind direction and force, more especially, and to some extent of other elements, are all more or less influenced by purely local conditions, such as the directions of the valleys, the intervention of neighbouring elevations, &c. Moreover, it is not feasible to obtain good and regular observations of clouds, the state of the atmosphere as regards haze, and especially the movements of the mass of the atmosphere above the level of the hill-tops. It is observations of this class, made by a trained meteorologist, who reasons, while he observes, that are now the great desideratum; and I think the time has come, when the propriety of establishing a first class observatory on some prominent hill-top, under the personal direction of a trained resident meteorologist, who is a good observer, is deserving of serious attention. It should be in the North-West Himalaya, as it is this part of the range that seems to be most influential as affecting the meteorology of Western India. There are several eminences suitable for the purpose, such as the Chor, the Shali or Hatu, or even the summit of the Mahasu ridge. The selection of a site would involve considerations of ready accessibility as well as free exposure; but this is a point that would require further consideration. Such an observatory would necessarily involve a considerable expense, for it is not mere mechanical observation that is required, but the intelligent observation of a person versed in atmospheric physics; and I think the importance of the work demanded would justify any reasonable outlay for this purpose.

In the interior of the Himalaya, we have the excellent observatory of Leh, which is admirably superintended by Mr. Ney Elias; and I have lately equipped one at Kailang, at an elevation of 10,000 feet in the Chundra Bhaga valley. The Rev. Mr. Heyde, who has very kindly undertaken the superintendence of this, has been, during the past winter, at Leh; and besides working himself at the observatory there established, has had a young Lahouli trained as an observer, who will accompany him to Kailang and undertake the work of observation. In the course of a few weeks, therefore, I expect this observatory to be at work, and we shall then have a very important station for furnishing information on the weather of the inner ranges, and reports on the condition of the spring snows. Two other observatories have been sanctioned, and I had hoped that Mr. Hill would have been able to establish one of these in Kumaon, but this has not as yet been practicable. Both Leh and Kailang are in valleys, and therefore subserve purposes quite different from those aimed at in the proposed observatory above noticed.

THE TEMPERATURE OF NORTHERN INDIA.—In Mr. Hill's Report on the administration of his department in the North-Western Provinces and Oudh,[1] mention is made of a piece of work which he completed shortly before the close of the year under report, *viz.*, the determination of the mean temperature and ranges of temperature in a large part of Northern India. He has collected and discussed all the existing records of temperature, and, after careful and somewhat laborious reduction and correction, he has laid down the results on charts, illustrating the distribution of the mean temperature of the year, that of each month, and the variations of the annual range of temperature. These are now in the lithographers' hands, and will be published, together with the descriptive memoir and the tabular data on which they are based, in the forthcoming part (II) of the 2nd volume of the Meteorological Memoirs.

The only previous charts of the kind are those issued, many years since, by the late Baron von Schlagintweit Sakünlünski, which, having been based on very imperfect data, have long since ceased to be regarded as other than a rough approximation to truth. As such, they were undoubtedly useful in their day.

One or two somewhat remarkable facts shown on Mr. Hill's chart of mean annual temperature may be here noticed. One of these is the low temperature, (after due allowance has been made for elevation,) of the region between Benares and Jubbulpore. The

[1] See Appendix B, page 61.

mean annual temperature of Benares is lower than that of Allahabad, Lucknow, or Patna; and that of Jubbulpore considerably less than that of Ranchi, Saugor, and even than Bikaneer, nearly 5° further north.

This is the more remarkable, that Jubbulpore is situated in the heart of India and is therefore under the conditions of a continental climate. Another tract of abnormal coolness lies immediately to the west of the Aravalli range. With these exceptions, the temperature, as a rule, increases from the coast steadily towards the interior; that portion that lies within the tropics having, however, a higher temperature than northern or extra-tropical India.

The annual range of temperature varies within the limits of India from only 40° at Bombay to nearly 90° at Mooltan and Dera Ismail Khan.

Chart of average rainfall of India.—In the report of last year, it was stated that steps were being taken to prepare a general chart of the average rainfall, and that some progress had then been made in the collection and reduction of the data. This work was completed during the last cold season, and a hand-drawn copy of the chart has been sent to the International Exhibition at Amsterdam; the original being handed over to the Lithographic Department of the Surveyor General's Office, for reproduction by lithography.

The original intention was to lay down the data on a contoured map of India; and with that view, a special map was compiled by the Surveyor General, from the data afforded by the Surveys, Railways, Irrigation Departments, &c. But it was found, on collocating the two charts of elevations and rainfall distribution, that it would be impracticable to represent both, with sufficient clearness, on one and the same sheet; and it has therefore been resolved to restrict each to the representation of one class of data.

The rainfall chart sent to the Amsterdam Exhibition was drawn on one of the maps of India, published by the Survey of India in two sheets, and on a scale of 64 miles to the inch. The lithographed chart for publication will be on the same scale. It will show 785 the names of ~~about 1,100~~ places, with the average rainfall of each, to the nearest integral inch; and the distribution of the rainfall will be shown by eight tints representing respectively the areas with an annual fall below 5 inches, from 5 to 10 inches, and further increments of 10 inches each up to 50 inches; finally from 50 to 70, 70 to 100, and above 100 inches. It will also show, by inscribed labels, the distribution of the rainfall according to season, which, as is well known, varies much in different parts of India. It is hoped that the lithographed chart may be completed for exhibition at Calcutta in the ensuing cold season.

The only general rainfall charts of India, previously published, as far as I have any knowledge, are *first* that drawn up by Dr. D. Brandis, the late Inspector General of Forests, in 1872, when engaged in the preparation of his work on the Indian Forest Flora, and published in volume II, No. 7 of *Ocean Highways;* and *second*, a revised edition of the same chart, prepared in my own office, and published in 1878.

The plan of these charts was almost identical. They represented the rainfall in four zones, *viz.*, with annual averages below 15 inches, from 15 to 30 inches, from 30 to 70 or 75 inches, and above 70 or 75 inches respectively. Dr. Brandis' original chart was on a small scale (264 miles to the inch) and gave the annual rainfall of 34 places. The Meteorological Office chart was on the same scale, and gave the annual fall of 106 places, but was based on the more extensive data of the 222 stations included in the table of average rainfall, published in the meteorological report for the year 1876. Both aimed at showing only the broader features of the rainfall distribution; and this they did, with the best data at the time available. The new chart is, therefore, a great advance on anything previously accomplished.

That portion of the chart, which represents the Punjab, has been laid down separately on a larger scale, and is being lithographed as an independant chart for the use of the Punjab Government. Mr. Hill, the Meteorological Reporter to the Government of the North-Western Provinces and Oudh, prepared from the original data, which he had collected and reduced, the rainfall chart of his own province, also on a large scale; this was incorporated in the general chart, and the original is also being reproduced for the use of the Local Government. Similar provincial charts can now be furnished, if required, to any of the Local Governments of India.

DISCUSSION OF THE RAINFALL DATA OF PAST YEARS.—With this work, I have also made considerable progress during the past cold season, in the intervals of leisure allowed by other current work.

The description of the normal distribution of the rainfall, according to place and season, and the circumstances which determine it, is now nearly completed, and some progress has been made with that of its vicissitudes and their causes. I distinguish four well-defined seasons of rainfall in different parts of India, *viz.*:—

1st.—The *spring storm rainfall,* which is chiefly restricted to the south and east of the peninsula, and the eastern half of Northern India. In Assam and Eastern Bengal, where it is heaviest, this passes by imperceptible gradations into—

2nd.—The *summer monsoon rainfall.*—This is emphatically the rainy season, except in the Carnatic and in Sind, and portions of the Punjab and Rajputana.

3rd.—The *autumn rainfall of the Carnatic*—Usually termed that of the north-east monsoon. But this appellation is shown to imply some misconception. It is really that of the transition from the summer to the winter monsoon; and it ceases when the north-east or winter monsoon is fairly established on the Coromandel coast.

4th.—*The winter rainfall of North-Western India.*—Of this well-known feature of Indian meteorology, no satisfactory explanation has, I think, ever been given; and its investigation has been not the least interesting part of the present enquiry. The general result at which I have arrived is, that the atmospheric disturbances, which bring about the winter rains, originate locally, and are determined by local evaporation in a still atmosphere. The vapour which is precipitated is, however, chiefly brought from the warmer lands and seas to the south, by the southerly winds, which always precede this rainfall, setting in towards the seat of diminished pressure.

Among the collateral results of the discussion, is the not unimportant conclusion, that local evaporation from the land surface, from rivers, irrigation tracts, swamps and perhaps forest, furnishes an appreciable quota to the vapour afterwards locally precipitated as rain. This appears from many considerations. The most salient instance of the fact is that furnished by the occurrence of occasional rain in Kashghar, where the only possible source of vapour is the evaporation from irrigated tracts. But India itself also furnishes many illustrative cases, among which, I would particularly mention the heavy spring rainfall of Assam, the increased precipitation along the course of the Indus, both in the Lower Punjab and Sind, and that also of the drainage basin of the Godavery. I am much inclined to the belief that the extension of the irrigation and tree-planting, more especially in such arid tracts as are portions of the Punjab, Rajputana, and Sind, are gradually bringing about an appreciable amelioration of the climate.

The question of the causes of drought in India is one that I have not yet fully worked out. But it is evident that it mainly resolves itself into that of the causes which, in certain seasons, determine an undue preponderance of the dry land winds,—winds which, as far as India is concerned, originate, in great part, within the enclosure of the culminating mountain barrier. As regards Northern and Western India, these are the regular winds of the spring months; but in favourable seasons they retreat, and over the greater part of the area disappear before the summer monsoon; and seasons of deficient rainfall and drought are mainly, if not entirely, due to their unseasonable persistence. The data, hitherto accumulated, are perhaps hardly sufficient to elucidate more than some portions of the problem thus presented to us for solution, and it may be that the present field of enquiry must be considerably extended before we can clear up many points involved in the issue; but I feel that the statement of the problem is gradually becoming clearer and more definite, and this is at least an important step towards its ultimate solution.

REGISTRATION OF RAINFALL.—It is satisfactory to learn from Mr. Hill's Administration Report, that steps have been taken to improve the registration of the rainfall in the North-Western Provinces and Oudh, by the issue of a more trustworthy form of gauge than that hitherto in use. These gauges have been issued to all revenue stations, which send reports of rainfall direct to the Allahabad Meteorological Office; and in order to obtain more correct values for the registers of past years, the new and old gauges will be read for a year simultaneously, and thus the relative values and errors of the old gauges will be determined.

Further steps have been taken during the past year to extend the registration of the rainfall to portions of the country previously unrepresented, and the following new registering stations have been established :—

Sitlaha	in Central India	from	January	1882.
Sohagpur	ditto (Rewah)	„	June	„
Jushpur	in Tributary mehals of Orissa	„	April	„
Gangpur	ditto ditto	„	June	„
Jagdalpur	in Bastar	„	July	„
Jeysulmere	in Rajputana	„	January	„
Kilba	in Bussahir (N-W. Himalaya)	„	April	„

A number of additional stations have also been selected from the lists of raingauge stations established by the Local Governments, and have been added to that of stations reporting to this office. This has been done in those parts of the country which were previously but sparsely represented, with a view to rendering the distribution of stations more uniform. Thus 2 have been added in the North-Western Provinces, 16 in Bengal, and 17 in Madras.

STORM RECORDS.—The study of the storms of Indian seas has received much attention from the officers of the Department, ever since its germ was planted, by the appointment of a Meteorological Committee by the Government of Bengal in 1864, and the still earlier labours of Piddington, in the same field of enquiry, rank among the classics of meteorological literature. Indeed, the foundations of the science of cyclonology was laid broad and deep by that active and devoted investigator, and his works will always form a store-house of valuable observation, equally necessary to the meteorologist and the seaman. But the physical theory of the origin and development of storms, and of the conditions on which they depend, is a study of later date, and it is in this field, more particularly, that Mr. Eliot has done some of his most important work. During the last year, he has made a very important addition to his previous writings, in a paper printed in Part I, Volume II, of the Indian Meteorological Memoirs, giving the detailed history of a small cyclonic storm, which originated over the Bay of Bengal and thence travelled northwards across Bengal, in the third week of November 1878. The discussion is very exhaustive. It takes cognizance, not only of the meteorological conditions prevailing over the Bay itself, but also of those on the land area around; and this for many days prior to the first appearance of the cyclone, as well as during its development and progress to extinction; and the conclusions, drawn from this history and summed up in the final pages of the memoir, are not the less important, that they are confirmatory of those which had been similarly induced from the study of previous storms in the Indian area. Mr. Eliot shows that its origin, existence, and motion were due entirely to the atmospheric conditions of the area visited by the storm, and not primarily and mainly to those beyond the area of the disturbance; while the changes that, at the season of its occurrence, are usually in progress over the land, went on, but little affected by the local disturbance over the Bay. The determining conditions were precisely those which, partly on the authority of Mr Eliot's previous memoirs, and partly on that of my own investigations, I summarised in Part II of the *Indian Meteorologist's Vade Mecum*. These, in Mr. Eliot's words, were "approximate uniformity of pressure over the storm area in Bengal and at the head of the Bay," accompanied by light, and, in a part of the area, variable winds. Hence "abnormal ascensional air-motion, on a large scale over the southern portion, at least, of the area of light airs and calms * * followed almost immediately by heavy and continuous rainfall, which, for a considerable period, was limited to this area. The course of the cyclone across Bengal took place where the air-motion was relatively least, prior to its arrival.

Following Mr. Eliot's Memoir in Part I, Volume II, of the Indian Meteorological Memoirs, is a list of cyclonic storms recorded on the west coast of India or on the Arabian Sea, drawn up by Mr. F. Chambers, shortly before his departure on sick leave. Mr. Chambers records 70 storms; and these show that the distribution of storms in the Arabian Sea, according to the times of year, is very similar to that in the Bay of Bengal. His own remarks on the list are very brief, and therefore in a short memoir which will appear in Part II of the volume, I have drawn attention to some particulars which seem necessary to the proper comprehension of Mr. Chambers' list, and have also given the history of one cyclone, which is of particular interest, as having originated over the plains of Gujarat. It probably may be taken as a type of a class of storms, of which the list furnishes other examples. This paper is now in the press.

THE METEOROLOGY OF INDIAN SEAS.—The arrival of Mr. W. L. Dallas, appointed Scientific Assistant to the Meteorological Reporter to the Government of India, in September last, has enabled me to put in hand, the very important work of reducing and discussing, for publication, the observations collected during 20 years (1856-1875) by the London Meteorological Office; and which, after sifting, correction and reduction to true places, and arranged according to geographical position in systematic data books, at the cost of the Indian Government, were received in this office in January 1877 and November 1880.

Prior to Mr. Dallas's arrival, some preliminary steps, in dealing with the barometric data, had been taken by Mr. Eliot; and Mr. Dallas, on proceeding to Calcutta in the earlier part of last October, took up the work systematically, beginning with the barometric and wind data of the Bay of Bengal for the month of January. This portion of his work has recently been brought to a completion, and a chart of the Bay (and the sea southward to the equator), on which the distribution of barometric pressure and winds in January are laid down on a well-understood plan, is now ready, and will be exhibited (together, it is hoped, with similar charts for February and March) at the forthcoming International Exhibition in Calcutta.

In general, the methods, followed by the London Meteorological Office, in laying down the corresponding data on the charts of the Cape of Good Hope, have been followed in the present case. But with respect to the barometric data, since the diurnal oscillation is large in Indian seas, whereas the geographical differences are comparatively small, it has been found advisable to correct the barometric readings, recorded at different hours, to a mean diurnal value, before taking their general average. And in the case of the winds, inas much as the Calcutta office is unprovided with the elaborate machine by which, in the wind roses of the Cape charts, the mean wind force and the proportion of gales are shown as areas of radial sectors of a circle, a much simpler plan of representation has been adopted; and both wind force and gales are indicated by numerals, appended to a very simple form of wind rose, which gives only the wind directions and the proportions of calms.

In taking out the various data, Mr. Dallas has been careful to record the occurrence and courses of the cyclonic storms, which, though rare, are occasionally generated in the extreme south of the Bay in the month of January; and some additions have thus been made to the list of cyclones of the Bay of Bengal, published in 1877, in the Journal of the Asiatic Society of Bengal. Four cyclones, including one of some severity, are thus found recorded during the 20 years.

The collection of current meteorological data, for the Bay of Bengal, has been undertaken as a special branch of work by Mr. Eliot, in accordance with the proposals submitted in paragraphs 39 to 44 of my report 3S of the 8th June 1881, and sanctioned in Government orders (Proceedings, Revenue and Agriculture, of the 27th October 1881). Observations are regularly recorded with duly verified instruments, on board the light-vessels off the mouth of the Hooghly; and a form of meteorological return, supplied by the Meteorological Office, is handed by the pilot to the captain of every vessel which reaches the Sandheads, together with a circular, specifying the information which it is desired to obtain; *viz.*, extracts of the meteorological entries in the log-book, referring to the weather experienced in the sea, north of the equator. Mr. Eliot reports that a large number of captains have complied with the request of the Department, and that, up to the 31st March, 345 sets of returns were filled up and transmitted to the office, many of which are of great value. This information is entered in books, in such manner, that all the observations for one day are entered on the same page; the form most convenient for transferring it to the daily weather charts, drawn up from the data of the land observatories.

Mr. Eliot remarks that these extracts clearly indicate the truth of what he had previously surmised, *viz.*, that the weather in the whole extent of the bay (excluding the Andaman Sea) is fairly indicated by the observations taken at the coast stations, and that the progress of every important storm may be traced and followed, with more or less exactness, almost from its origin, from the shore observations.

STORM-WARNING SYSTEM, CALCUTTA.—The new system of storm signals, noticed in my report of last year, was brought into operation last August, after notification in the *Calcutta Gazette.* Under this system, signals giving warning of any dangerous storm near the head of the Bay, are hoisted at Saugor Island, Mud Point, and Diamond Harbour. But in Calcutta, only before the approach of a severe cyclone, with a storm wave of sufficient magnitude to be probably dangerous and destructive to shipping in the Port. On such occasions they will be hoisted at three stations, *viz.*—

The Port Commissioners' Office.
On a flagstaff at Seebpore nearly opposite the Fort.
On a flagstaff near the Government Dockyard, Kidderpore.

The system of signals, for stations below the port, is designed to distinguish between the violent storms which are restricted to the periods of the change of monsoon, (May, June, and October, November), and those feebler but more frequent storms which occur during the summer monsoon; and they will also indicate, generally, what part of the Bengal coast the storm is likely to cross.

Six storms were recorded during the past year; only two of which appeared to be of such strength, as to justify the hoisting of the signals.

STORM-WARNING SYSTEM, BOMBAY.—This system has been worked during the greater part of the year, by the Officiating Meteorological Reporter for Western India, Mr. Pearson; in the same manner as in previous years. Mr. Pearson has sent in a report recommending some extensions, which will be duly considered. I am, however, of opinion that, until the storms of the Bombay coast have been carefully studied in detail, in the manner that has been practised for many years in the Bengal side, and until much more information is gained respecting the origin and courses of these storms, it is premature to make any considerable alteration in the present system.

DAILY WEATHER REPORT.—The daily reports issued by the Government of India give the substance of the weather telegrams, received from 88 stations,[1] (including that of the place of publication), and during the rainy season, rainfall returns from 35 additional stations, together with a verbal descriptive summary. This summary was continued through the cold season, for the first time during the past year. Since May 1882, it has been telegraphed to the Local Governments, the Meteorological Reporters, &c., and upwards of 300 copies of the printed report are issued daily, to officials and others, including the divisional and district officers of the Northern Provinces of India, and those meteorological offices in Europe and elsewhere, that exchange publications with this Department.

An improved and extended system of daily report has also been established in Bengal, but did not come into operation until after the close of the year under report. Some account of it will be found in the Administration Report of the Meteorological Reporter for Bengal (Appendix A).

CALCUTTA TIME SIGNALS.—Up to the 8th May 1882, only one time-ball was worked from the Alipore Observatory, *viz.*, that over the Port Commissioners' Office. From that date, the new time-ball on the Semaphore tower, Fort William, was also brought into operation; and, except on a few days, on which the communications of one or the other ball were faulty, both time-balls have been dropped regularly ever since.

The arrangements for firing the time-gun by electricity are, I regret to say, not yet complete. The apparatus has been put in good order and works well, and it was set up in an empty expense magazine on the time-gun bastion. The gunner was trained in its use by the officers of the Electric Telegraph Department; and when all was so far ready, it was found, shortly before the close of the year under report, that the apparatus required a fuze not usually kept in store. An indent for the proper fuzes was sent to the ammunition factory, and not being procurable there, was sent home, and I have not yet heard of the receipt of the supply.

---

[1] Since increased to 93.

THE ALLAHABAD OBSERVATORY.—The establishment of a first class observatory at Allahabad, which was originally sanctioned in 1875, and for which a costly meteorograph has been obtained from Europe more than two years ago, has, I regret to say, made but little progress. This, as appears from Mr. Hill's report, is owing to certain difficulties with reference to the site selected for the new observatory. As stated by Mr. Hill, "Plans for a building to accommodate the observatory and the Meteorological office are now being prepared in the Executive Engineer's office at Allahabad. But it is possible that the question of a site for the observatory may have to be re-opened; because, at the site already determined upon in he Muir College compound, no building, except one designed by the architect of the college, can be erected, without the possibility of injuring the College from an architectural point of view. I understand that, for this design, heavy fees are demanded by the architect, and hence the provision of an observatory is at a stand-still." The dilemma does not appear to be one from which an escape should present many difficulties, and meanwhile there is not a small risk that the value of much of the work already done at Allahabad may be sacrificed. The present observatory is at Mr. Hill's private house and must be removed, sooner or later. In order that the observations to be recorded at the future observatory may be rendered comparable with those made, for many years past, at the present site, series of comparative observations must be recorded continuously for one or two years at both; and this work has been in progress, for nearly fifteen months, with a view to the removal to the Muir College. As Mr. Hill remarks, "should a new position be determined upon, the observations of temperature and humidity which have been made at the College since the middle of April 1882, and are still being carried on, will be useless."

PART II.—OBSERVATORIES.

In the report of last year, 123 observatories were enumerated, as having contributed registers to this office up to the close of the year; including 12 attached to various Government offices, but not paid for by the Department, and six which were either private and independent establishments, or were worked by volunteers; the instruments only having been furnished by the Department. Four have been added to this list during the past year, *viz.*:—

Gopalpore and Kurnool in Madras (3rd class).

An observatory at Dehra Dun attached to the Forest School, primarily as a means of instruction to the Forest students.

And Tura in the Garo Hills (4th class).

And the old observatory at the Electric Telegraph Office at Darjeeling was suppressed in October, 1882, having completed a year's working, simultaneously with the new observatory at St. Paul's school.

Two other stations have also been provided with instruments, but have not yet sent in registers, *viz.*:—

Kailang in Lahoul (3rd class).
Seychelles Islands (ditto).

Excluding the two last, there were, therefore, 127 observatories, contributing registers during the year; which were distributed in the several provinces as follows:—

Indian Empire.

Bengal and Assam	23
N.-W. Provinces and Oudh	18
Punjab	11
Central Provinces	11
Berar	5
Central India and Rajputana	10
Bombay	14
Madras, Mysore, Coorg, and Hyderabad	17
British Burma	8
Bay Islands	2
Lakhadives	1
TOTAL	120

Extra Indian Settlements and Foreign States.

Nepal	1
Kashmir territories	1
Beluchistan	1
Goa	1
Persian Gulf	1
Aden	1
Zanzibar	1
TOTAL	7
GRAND TOTAL	127

Of the whole number, 3 were first class observatories, with instruments registering autographically;[1] 25 second class observatories; at all but two of which, in addition to observations at 10h. and 16h., hourly readings are registered on four (in some cases three) days in each month; and at all but one of these latter, synoptic observations are also registered daily at 7h. Washington mean time, (=18h. 1m. Calcutta mean time). The remainder, with four exceptions, are third class stations, registering two full sets of observations, (and in the case of certain of the Madras stations, three sets) daily. The four excepted stations—Chowringhee (Calcutta), Mongpoo, Demagiri, and Makhla—register only temperature, rainfall, and wind direction. The observatories may further be classed as—

	Class.			
	1st.	2nd.	3rd.	4th.
A—Government observatories with paid observers under the Meteorological Department	1	25	81	1
B—Independent or attached to Government offices, observers not paid by the Meteorological Department .	1	0	8	4
C—Private and foreign observatories	1	1	4	0
TOTAL . .	3	26	93	5

OBSERVATORIES IN BENGAL AND ASSAM.—*The Alipore Observatory.*—This observatory serves as a general depôt for the verification of instruments, as well as for observations of an experimental character; and an important part of its work is the control of the time signals for the port of Calcutta. It is immediately superintended by the Reporter to the Government of India; and the establishment is under the immediate charge of the Chief Observer, Baboo Brojo Mohun Rakhit, B.A.

The work of the observatory consists of—

1st.—Continuous registration, by autographic instruments, of the duration of bright sunshine, of the atmospheric pressure, temperature, moisture (dry and wet bulb thermometers), wind direction, movement and pressure, and the rainfall.

2nd.—Periodical readings of the barometer, dry and wet bulb thermometers (including maximum and minimum), the raingauge and the actinometer, and estimates of cloud proportion. The temperature readings include those of the temperature of the air in shade, under a shed of the usual pattern, those of nocturnal radiation and insolation, and those of the ground at the surface, and at 1 foot and 3 feet deep.

3rd.—The verification of all thermometers issued to observatories throughout India, with the exception of those under the Meteorological Reporters for Western India and Madras; and the comparison of all barometers with the Calcutta standard.

4th.—The determination of the mean local time, by meridian observations of the sun, and the working of the time signals for the guidance of the shipping in the port.

The observations of temperature at 4 feet and 40 feet above the ground, having been carried on for four years, were discontinued on the 1st April 1882, the palm stem, on which the elevated thermometers were set up, having become so decayed at top, as to be thought unsafe.

---

[1] These do not include the observatories furnished with anemographs only, which are more numerous.

The establishment, for the above purposes, consists of—

Babu Brojo Mohun Rakhit, B.A.	Chief Observer.
,, Khetra Mohun Mukerjee	1st Photo. Asst.
,, Mahendra Nath Bhattacharja[1]	2nd ditto.
,, Annoda Prosad Banerjee, B.A.	
,, Mahendra Nath Banerjee	Observer.
,, Syam Lall Sen	Ditto.

2 Artificers.
1 Batteryman.
6 Servants.

The autographic instruments consist of the Kew barograph and thermograph, which register by photography, a Beckley's anemograph, an Osler's anemometer, and a Beckley's raingauge. During the past year, all the instruments have worked well; and since, on the recommendation of Major Waterhouse, Morgan's *argento bromide* paper has been substituted for the waxed paper previously in use, there has been a very great improvement in the photographic traces, which are now, as a rule, all that can be desired. The cost of this sensitized paper is no greater than that of the paper and chemicals, which it has displaced, while all the operations are simplified, and the Assistants have more time to devote to the observatory work. In every respect, therefore, the change has been most beneficial.

The following table gives a comparative review of the mean results of the autographic registers of the barograph and thermograph, and of the eye-readings of the barometer and thermometers, recorded at the same hours. The standard barometer has the cistern about 1 foot higher than the barograph, and the standard thermometers are exposed under a shed, open all round, while the bulbs of the thermograph are under a louvred pent-house against the north wall of the observatory.

Comparative mean reduced readings of barograph and standard barometer in 1882.

1882.	STANDARD BAROMETER.					BAROGRAPH.				
	6 hours.	10 hours.	16 hours.	22 hours.	Mean.	6 hours.	10 hours.	16 hours.	22 hours.	Mean.
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
January	30·036	30·107	29·970	30·043	30·039	30·037	30·118	29·979	30·054	30·047
February	29·942	·017	·878	29·948	29·946	29·943	·020	·881	29·960	29·951
March	·846	29·918	·778	·860	·851	·853	29·927	·782	·868	·858
April	·749	·809	·677	·760	·749	·750	·817	·684	·764	·754
May	·703	·743	·622	·719	·697	·699	·750	·627	·719	·699
June	·536	·570	·475	·564	·536	·530	·570	·481	·560	·535
July	·510	·538	·446	·538	·508	·502	·537	·444	·538	·505
August	·617	·658	·560	·649	·621	·611	·661	·558	·648	·620
September	·697	·745	·632	·716	·698	·692	·749	·633	·716	·698
October	·776	·830	·724	·788	·780	·772	·827	·726	·783	·777
November	·952	30·008	·894	·968	·956	·936	·997	·881	·956	·943
December	·998	·054	·929	30·009	·998	·978	30·045	·919	·997	9·85
Year	29·780	29·833	29·715	29·797	29·782	29·775	29·835	29·716	29·797	29·781

---

[1] To the 20th May 1882; after which, Babu Annoda Prosad Banerjee was appointed.

Comparative mean readings of the thermograph and dry bulb thermometer in the thermometer shed in 1882.

1882.	THERMOMETER IN SHED.					THERMOGRAPH.				
	6 hours.	10 hours.	16 hours.	22 hours.	Mean.	6 hours.	10 hours.	16 hours.	22 hours.	Mean.
	°	°	°	°	°	°	°	°	°	°
January . . .	59·8	70·1	78·1	64·0	68·0	60·8	68·9	76·8	64·6	67·8
February . . .	61·9	73·4	80·0	66·4	70·4	63·0	72·5	79·1	67·4	70·5
March	71·7	83·6	91·7	76·9	81·0	72·5	83·0	91·0	77·7	81·1
April	75·9	87·4	92·3	80·0	83·9	77·0	87·5	92·8	80·9	84·6
May	77·3	86·2	89·9	78·6	83·0	77·8	87·1	90·5	79·9	83·8
June	80·1	86·0	85·5	81·0	83·2	80·7	86·7	86·6	81·9	84·0
July	79·4	84·3	84·4	81·0	82·3	79·9	85·1	85·1	81·4	82·9
August	78·6	83·6	83·4	79·5	81·3	79·2	84·8	84·3	80·3	82·2
September . . .	78·5	84·3	84·2	80·0	81·8	79·1	84·5	85·0	80·7	82·3
October	74·9	81·5	82·8	76·9	79·0	75·8	81·4	82·7	77·4	79·3
November . . .	67·7	76·2	79·2	69·9	73·3	67·9	75·3	78·5	70·0	72·9
December . . .	58·5	70·2	76·3	62·5	66·9	59·9	69·0	75·2	63·1	66·8
Year . .	72·0	80·6	84·0	74·7	77·8	72·8	80·5	84·0	75·4	78·2

Comparative mean readings of the thermograph and wet bulb thermometer in the thermometer shed in 1882.

1882.	WET BULB IN SHED.					THERMOGRAPH.				
	6 hours.	10 hours.	16 hours.	22 hours.	Mean.	6 hours.	10 hours.	16 hours.	22 hours.	Mean.
	°	°	°	°	°	°	°	°	°	°
January . . .	58·2	63·0	63·8	61·1	61·5	58·6	62·4	64·2	61·5	61·7
February . . .	59·2	64·1	65·0	62·3	62·7	59·9	64·3	65·9	63·4	63·4
March	69·7	72·7	71·2	72·1	71·4	70·1	73·1	72·6	72·7	72·1
April	73·3	75·9	74·8	74·8	74·7	73·2	75·7	74·9	74·9	74·7
May	74·8	77·4	77·4	73·9	75·9	74·1	77·5	77·5	73·9	75·8
June	78·4	80·4	80·1	78·8	79·4	78·4	81·1	80·8	79·2	79·9
July	78·1	79·9	79·9	78·7	79·2	78·3	80·3	80·5	79·1	79·6
August	77·6	79·3	79·0	77·8	78·4	77·4	80·0	79·8	78·2	78·9
September . . .	77·5	79·4	79·0	78·4	78·6	77·7	79·7	79·8	78·7	79·0
October . . .	73·6	75·6	75·7	75·2	75·0	74·1	76·0	76·2	75·3	75·4
November . . .	65·5	68·5	68·7	67·2	67·5	65·1	67·8	68·7	67·1	67·2
December . . .	57·0	62·9	64·1	59·9	61·0	57·3	62·3	63·7	60·2	60·9
Year . .	70·2	73·3	73·2	71·7	72·1	70·4	73·4	73·7	72·0	72·4

Up to the 15th February 1883, the readings of the Stewart's actinometer were made on all clear days, as in the previous two years, at apparent noon and two hours before and after. From that date they have unavoidedly ceased, as the instrument was urgently required at Mussooree, as has been explained in the introductory portion of this report (p. 3). The results for the past year, after reduction, will be sent home to the Solar Physics Committee.

The sunshine recorder, an instrument for registering the duration of bright sunshine, by means of a glass globe which concentrates the sun's rays on a strip of card (burning a trace on it as long as the rays are sufficiently powerful), was brought into use on the 14th November 1882, and is an useful addition to the actinometer and solar thermometer.

The observations of ground temperature have been steadily continued, the thermometers being read three times daily, at intervals of 8 hours; hourly observations, from 6 A.M. to 10 P.M., were also made for 31 days each in the months of July and December. These show the course of diurnal variation in the rains and cold weather, (after graphic interpolation for the remaining night hours); and, together with the series recorded in March and April, which was mentioned in last year's report, afford data for the correction of the eight-hourly observations to true diurnal means. The following table gives the results of the eight-hourly readings of the three thermometers and the monthly means, together with the mean air temperature for comparison :—

Mean temperature of ground at Alipore in 1882-83.

MONTHS.	SURFACE.			1 FOOT DEEP (OLD).			1 FOOT DEEP (NEW).			3 FEET DEEP.			MEANS.			
	5¾ hours.	13¾ hours.	21¾ hours.	5¾ hours.	13¾ hours.	21¾ hours.	5¾ hours.	13¾ hours.	21¾ hours.	5¾ hours.	13¾ hours.	21¾ hours.	Air in shade.	Surface.	1 foot deep (old).	3 feet deep.
April 1882 . .	79·0	110·5	84·0	85·6	86·0	87·0	...	...	...	84·9	85·0	85·0	84·3	91·2	86·2	85·0
May ,, . .	80·7	104·5	82·8	87·0	87·1	87·8	...	...	...	86·5	86·6	86·6	83·7	89·2	87·3	86·6
June ,, . .	83·3	95·0	84·6	87·2	87·1	87·6	...	...	...	87·1	87·1	87·1	83·8	87·6	87·3	87·1
July ,, . .	83·2	92·7	84·6	86·8	86·6	87·0	...	...	...	86·9	86·9	86·9	82·8	86·8	86·8	86·9
August ,, . .	82·7	92·5	84·2	86·1	86·1	86·4	...	...	...	86·6	86·6	86·6	81·9	86·5	86·2	86·6
September ,, . .	82·1	93·4	84·0	85·8	85·8	86·0	...	...	...	86·1	86·2	86·2	82·2	86·5	85·9	86·2
October ,, . .	77·5	90·8	79·5	82·8	82·8	83·0	...	...	...	84·6	84·6	84·7	79·2	82·6	82·9	84·6
November ,, . .	70·3	83·8	72·7	77·3	77·3	77·5	...	...	...	80·8	81·2	81·1	73·1	75·6	77·4	81·0
December ,, . .	61·3	77·6	64·7	70·7	71·0	71·0	...	...	...	75·6	76·1	76·0	66·3	67·9	70·9	75·9
January 1883 . .	58·3	74·0	62·2	67·0	67·5	67·6	...	...	...	71·9	72·5	72·2	63·9	64·8	67·4	72·2
February ,, . .	62·5	78·9	66·5	69·6	69·8	70·3	...	...	...	72·7	72·9	72·8	67·5	69·3	69·9	72·8
March ,, . .	72·1	97·1	76·5	76·9	77·0	77·9	77·6	77·1	78·8	77·2	77·3	77·4	77·9	81·9	77·3	77·3
Means .	74·4	90·1	77·2	80·2	80·3	80·8	...	...	...	81·7	81·9	81·9	77·2	80·8	80·5	81·8

The table shows anomalies similar in kind to those noticed in the last two annual reports. The temperature, at 3 feet deep, is 4·6° in excess of that of the air and 1·3° above that at 1 foot deep. This last difference is, however, exaggerated, and the excess is partly due to the temperature of the 1 foot thermometer being lowered, about 0·6°, by the nocturnal convection of the air, within the tube which contains the thermometer. This subject will be noticed in the Report on the Meteorology of 1882.

The number of instruments verified at the Alipore Observatory during the year ending March 1883 is as follows:—

1. Barometers	45
2. Aneroid	1
3. Dry and wet bulb thermometers	23
4. Maximum thermometers for air temperatures	10
5. Minimum do. do. do.	25
6. Do. do. for nocturnal radiation	41
7. Solar radiation do.	22
8. Standard do.	4
9. Common do.	10
10. Six's do.	1
TOTAL	182

And the following is a summary of those received and issued by the Observatory Store Department:—

	Received.	Issued.
1. Barometers	41	32
2. Aneroid	1	1
3. Dry and wet bulb thermometers	9	12
4. Maximum thermometers for air temperatures	11	15
5. Minimum do. do. do.	17	27
6. Do. do. for nocturnal radiation	53	36
7. Standard do.	2	2
8. Solar radiation do.	5	17
9. Actinometer (Stewart's)[1]	1	1
10. Anemometers	15	5
11. Anemoscopes	1	3
12. Sling thermometers	10	0
13. Six's thermometer	1	1
14. Common thermometers	0	9
15. Thermometers for Stewart's actinometer	0	2
TOTAL	167	163

The time signals were given, during the whole year, by the ball on the Port Commissioners' Office, and also, since the 8th May 1882, by the new ball on the Semaphore tower on Fort William. Both balls have been dropped accurately on 237 days. On 45 days only one ball gave the signal, the other either having failed or not having been brought into use. Of the 83 remaining days 79 were Sundays or public holidays. On three days, prior to the 8th May, the single ball failed, and on one day both balls failed to act. The failures have been, in nearly all cases, due to some failure in the communicating wire, generally through accidental contact with a conductor.

[1] This was in use at Alipore.

The following is a return of the failures of each time-ball :—

Port Commissioners' Office.

Dates of failure.	Nature of failure.
22nd April 1882 . . .	Dropped 2·00 sec. too late
25th „ „ . . .	„ 1·25 sec. „
1st May „ . . .	Failed.
8th „ „ . . .	Did not drop correctly.
2nd June „ . .	From return signal it could not be ascertained whether the trigger was discharged at the hoisting signal and also at the dropping signal. Hence the working of the ball was doubtful.
1st July „ . .	Failed.
17th „ „ . . .	Do.
19th „ „ . . .	Doubtful.
20th „ „ . . .	Do.
21st „ „ . . .	Failed.
25th August „ . . .	Return signal at dropping unintelligible.
3rd Nov. „ . . .	Failed.
1st. Dec. „ . . .	Do.

Semaphore tower, Fort William.

Dates of failure.	Nature of failure.
13th May 1882 . . .	Failed.
23rd June „ . . .	Hoisted, but did not drop.
12th July „ . . .	Failed.
20th „ „ . . .	Did not drop.
25th „ „ . . .	Dropped many seconds after mean 1 P.M.
10th August „ . . .	Failed.
27th Nov. „ . . .	Do.
6th March 1883 . . .	Do.
7th „ „ . . .	Do.
8th „ „ . . .	Do.
21st „ „ . . .	Do.
22nd „ „ . . .	Dropped few seconds after mean 1 P.M.

For the reasons explained in the introductory portion of this report, the time-gun is not yet fired by electricity.

OTHER OBSERVATORIES IN BENGAL AND ASSAM.—Including the old Darjeeling observatory at the Electric Telegraph Office, which was suppressed in October 1882, and the new fourth class observatory at Tura in the Garo Hills, which commenced work in

March 1883, there were altogether, in addition to Alipore, 22 observatories in these provinces, during the whole or part of the year. These were :—

Second Class.

Sibsagar.
Dhubri
Bankipore.
Hazaribagh.
Saugor Island.
Cuttack.
Chittagong.

Third Class.

Darjeeling (1st Paul's School).
„ (Electric Telegraph Office).
Purneah.
Durbhanga.
Gya.
Berhampur.
Burdwan.
Jessore.
Dacca.
Silchar.
False Point.

Fourth Class.

Calcutta (Chowringhee).
Demagiri.
Tura.
Mongpoo.

Mr. Eliot's Report, (Appendix A) gives the names of the Superintendents and observers at all the second and third class stations, and at Demagiri and Tura. The Chowringhee Observatory is attached to the Meteorological Office, the clerks of which take the observations, and Mongpoo is included in the special list (Appendix E).

Three of the second class observatories and all of the third class (excepting Jessore and Silchar) were inspected by Mr. Eliot, and a detailed account of the results of the inspection, as well as an opinion on the working of the remaining observatories, is given in his report. Cuttack, Dhubri, and Saugor Island are stated to be the best of the second class, and Berhampur, Dacca, Burdwan, Darjeeling, and False Point the same of the third class observatories. Hazaribagh and Bankipore (Patna), which were unfavourably reported on last year, have improved, but it has been necessary to dismiss the observer at the former station for deliberate falsification of his registers. Purneah has improved ; and, as far as can be judged from the registers, Silchar and Jessore also, especially the latter ; but Gya and Durbhanga are far from satisfactory.

The observatory at False Point was in abeyance from the 25th April to the 7th August, owing to the unexpected closing of the Electric Telegraph Office at Jumboo, at which the observatory was situated. No notice having been received of the intention of the Electric Telegraph Department to close this office, no arrangements had been made for transferring the instruments and the work elsewhere, nor could any satisfactory arrangement be made until, in August, the light-house at False Point was brought into telegraphic communication with Cuttack, when the observatory was re-established at this its original site. The temporary suppression was very prejudicially felt, as this is the station from which, in general, the earliest decisive report is received of any cyclone likely to approach Calcutta. For this purpose the telephone, although better than nothing, is very inferior to the Morse instrument, as communication fails in stormy weather.

Self-recording anemographs are at work at Darjeeling, Dhubri, Hazaribagh, Chittagong, Saugor Island, and Cuttack, as well as at the Alipore Observatory. At the first three stations and Cuttack, they are those of Casella's pattern ; at Chittagong, Saugor Island, and at Calcutta those of Beckley's. The first instrument is found at these stations, as indeed, elsewhere, to work unsatisfactorily in light winds, and indeed to be generally unsuitable for India. It was tried, as being only half as expensive as the Beckley; but the experiment has not been successful.

The following observers have been selected for especial allowances during the current year, that marked * being now awarded for the first time, while that marked † has been raised from Rs. 5 to Rs. 10 :—

Names.	Stations.	Amounts. Rs.
Mokhoda Prosad Chowdhri	Burdwan	10
J. C. Smith	Cuttack	10
Mohendro Nath Roy	Berhampur	10
† Maniruddin Ahmed	Dhubri	10
Dandadhur Datta Barua	Sibsagar	5
Jogin Chunder Banerjee	Durbhanga	5
* H. W. Alley	Cuttack	5

OBSERVATORIES IN THE N.-W. PROVINCES AND OUDH.—Excepting that an observatory has been established at the Forest School, Dehra Dun, in addition to that already existing at the Office of the Survey of India, the observatories of these provinces are the same as were enumerated in the report for last year, *viz.* :—

Second Class.

Allahabad.
Agra.
Lucknow.
Roorkee.

Third Class.

Chakrata.
Ranikhet.
Mussooree (St. Fidelis).
Do. (S. G. Office).
Dehra (S G. Office).
Dehra (Forest School).
Bareilly.
Meerut.
Gorakhpur.
Ghazipur.
Benares.
Jhansi.
Pauri.
Pithoragarh.

Mr. Hill's Report (Appendix B) gives the names of the Superintendents and observers, and the results of his inspection of Lucknow, Agra, Ranikhet, Bareilly, and Jhansi. He also remarks on the work of the other observatories. With the exception of Bareilly, where the instruments were dirty and neglected, and Jhansi, where the building was somewhat out of repair, the condition of the observatories is reported to have been generally satisfactory, and, with slight exceptions, the work of the observers is also favourably reported on.

The new difficulties that impede the provision of a building for the Allahabad observatory, and which threaten to render useless much of the work, already done, with a view to ensuring the continuity of the records, have been noticed in the introductory portion of this report.

Special allowances for satisfactory work have been allotted for the current year to the following observers :—

Names.	Stations.	Amounts. Rs.
Chotay Lall	Lucknow	10
Kadernath Chatterjee	Allahabad	10
† Jewa Nand	Ranikhet	10
Mir Altaf Ali	Agra	5
Saligram	Chakrata	5
* Chiranji Lal	Roorkee	5
Devakinandan Pathak	Benares	5

OBSERVATORIES IN THE PUNJAB.—No change has been made in the observatories of this province, which, during the past year, were as follow:—

Second Class.

Lahore.

Third Class.

Mooltan.
Dera Ismail Khan.
Peshawar.
Rawalpindi.
Sialkot.
Murree.
Sirsa.
Ludhiana.
Simla.
Delhi.

The names of the Superintendents and observers are given in Dr. Lawrie's Report (Appendix C). The observatories of Simla, Delhi, Ludhiana, Rawalpindi, Murree, and Dehra Ismail Khan were inspected by Dr. Lawrie in September, but no details of the results are given in the report.

Lahore and Murree rank as the best observatories in the Punjab; Rawalpindi as the worst. The barometric readings of this last station have always been very untrustworthy, and, so late as January last, the readings were so anomalous as to necessitate their being returned to the Punjab office for report. No report has, however, yet been received; but of late there has been an apparent improvement, to judge from the telegraphic reports.

At Simla, I had occasion also to draw the attention of the observer to the systematic inaccuracy of the barometric readings, and on one occasion to an evident error in the rainfall report.

Dr. Lawrie reports that the year showed considerable improvement in the character of the work of all the observatories. To his remark that he has little or no complaint to make against any of the observers, I think, however, that the errors detected in my own office in the work of Rawalpindi and Simla, show that the observers of these stations must form an exception.

Special allowances for the current year have been awarded to observers as follow, the new recipients being designated by an (*):—

Names.	Stations.	Amounts.
		Rs.
Fazal Rahman	Sirsa	5
Kashi Ram	Peshawar	5
(*) W. Cruikshank	Murree	5
(*) Jaspat Rai	Lahore	5
(*) Divan Chand	Do.	5

OBSERVATORIES IN THE CENTRAL PROVINCES.—As in previous years, these are eleven in number, *viz.*, three of the 2nd and eight of the 3rd class, *viz.*:—

Second Class.

Nagpur.
Jubbulpore.
Pachmarhi.

Third Class.

Saugor.
Hoshangabad.
Seoni.
Khandwa.
Chanda.
Sironcha.
Raipur.
Sambalpur.

The report of the Deputy Surgeon General and Sanitary Commissioner, who locally controls these observatories, is given in the Appendix D I, and a nominal list of Superintendents and observers in Appendix D II. Appendix D III is some notes on the results of an official inspection of the observatories at Khandwa, Jubbulpore, Seoni, Nagpur, Sambalpur, Raipur, and Chanda, by Dr. B. Simpson, who held the post of Deputy Surgeon General during the year under report.

The Saugor observatory was closed and the observations were in abeyance, from June to October. The native observer, Dindyal, had been repeatedly warned and fined for persistent falsification of his registers, by inserting imaginary readings of the barometer; and proving incorrigible, he was at length dismissed, on the 4th June 1882. A long delay ensued before another observer was selected and trained, and the work was not resumed until the 18th October. His work has proved so far satisfactory. As Dindyal's barometric registers, for more than two months prior to his dimissal, had to be rejected, there is altogether a hiatus of seven months in the registers of this station.

The observer at Jubbulpore, Banikanta Rai Chowdhri, who had been sent up from Calcutta, also proved unsatisfactory, and he was allowed to resign in June 1882. The work of the remaining observers has been generally satisfactory. The Raipur reports have been more frequently erroneous than those of other stations.

Special allowances have been allotted to the following for the current year:—

Names.	Stations.	Amounts.
		Rs.
T. V. Allaghiri Swami	Nagpur	10
Jadu Nath Bosu	Hoshangabad	5
Sham Soondar Dass	Sambalpur	5
Seetaram	Chanda	5
Puncham [1]	Seoni	5

Two stations, *viz.*, Nagpur and Jubbulpore, are provided with autographic instruments for registering the wind. That at Nagpur, a Beckley's anemograph, has worked in a very satisfactory manner; but that supplied to Jubbulpore, a cheaper form of instrument by Casella, has never yielded any useful results, owing to inherent defects of the design. These instruments have proved equally unsatisfactory elsewhere.

OBSERVATORIES IN BERAR.—There are five of these, as in the previous year, all of the third class, with the exception of Makhla, which is of the fourth class, and has been established by the Forest Department, but contributes registers to this office. They are—

Third Class.

Akola.
Buldana.
Chikalda.
Amraoti.

Fourth Class.

Makhla.

The list of Superintendents and observers, at the first four observatories, is given in the Table (Appendix F II), appended to the Report of the Officiating Meteorological Reporter for Western India, under whose control, jointly with the Sanitary Commissioner of the province, these observatories work. Those of Makhla are enumerated in Appendix E.

---

[1] Now first allotted.

Only one of the above has been inspected during the year, *viz.*, Amraoti, which was visited by Mr. Pearson, with a view to reporting on the proposed removal of the observatory to another site in the neighbourhood. With the exception of the anemometer and its registers, the instruments and the work of the observatory were found to be satisfactory.

The barometric registers of Chikalda are very inconsistent with those of other stations, and at present of little value. During two years they were vitiated by the condition of the barometer, the mercury of which had become thickly coated with oxide, so that accurate readings were impracticable; and even when these have been eliminated, the inconsistencies are only somewhat reduced, and by no means disappear. The Reporter for Western India has lately been requested to subject the whole to a careful examination.

The barometric registers of Buldana also, during the past year, are inconsistent with those of previous years, and with those of other stations in the neighbourhood, owing to some constant cause of error, which the Reporter for Western India has been requested to investigate.

The following observers have had special allowances allotted to them for the year now current :—

Names.	Stations.	Amounts. Rs.
† Samuel Gregory	Akola	10
Bukaram Pandurang	Amraoti	5

OBSERVATORIES IN CENTRAL INDIA AND RAJPUTANA.—The number of these observatories is the same as during the previous year, *viz.*, ten; but one, Jeypore, established and maintained at the expense of the Jeypore Durbar, has been raised to the status of a first class observatory, by the introduction of autographic registration. The list is therefore as follows : —

First Class.

Jeypore.

Third Class.

Sutna.
Nowgong.
Neemuch.
Indore.
Mount Abu.
Pachbudra.
Ajmere.
Sambhar.
Bickaneer.

The Van Rysselberghe's meteorograph, purchased from the Government of India, for the Maharajah's observatory at Jeypore, was brought into working at the beginning of the year under report. Many difficulties have been met with; first, owing to some injuries which the instrument had received in transport, and afterwards in finding out the proper methods of working; but these were eventually overcome, partly by the skill of a native mechanician, Nand Kishore, a man of remarkable mechanical endowments, in the service of the Durbar, and partly by the intelligent assistance afforded by the local Electric Telegraph Master, Mr. Callaghan. It is, however, to Dr. Hendley, the Superintendent of the Observatory, that must redound the credit of having established the observatory and of having brought it to its present very efficient condition. Some minor difficulties remain yet to be overcome, before the meteorograph will furnish the printed facsimiles of the traces; difficulties partly arising from the action of extreme dryness and heat on the parts of the instrument; but a considerable series of successful records have already been obtained; and the same skill and energy, which have accomplished so much, will doubtless achieve complete success in the end.

The observatories at Sutna, Nowgong, Ajmere, and Sambhar are under the Reporter to the Government of the North-Western Provinces; those of Neemuch, Indore, Mount Abu and Bickaneer under the Reporter for Western India; and the names of the Superintendents and observers are given in the lists of their respective Reports (Appendices B and F II). Pachbudra is under the Commissioner of Northern India Salt Revenue, and reports direct to the Central Office in Calcutta [Appendix E].

Jeypore was visited by myself in November, and by Mr. Hill in the following month; and Mount Abu, Neemuch, and Indore were inspected by Mr. Pearson.

The observatory at Mount Abu has contributed a continuous register since April 1882, but the barometric register is evidently erroneous; and although a large error was discovered in the readings of the barometer, when the station was inspected by Mr. Pearson, this does not account for those of the registers; which must, therefore, be rejected. In spite of the printed standing orders, with which every observatory is furnished, the observer was found to be taking his observations according to Madras time, and this was the case at several other stations under the Reporter for Western India.

At Neemuch, also, this practice of observing according to Madras time was followed, and the anemometer was somewhat injured; and at Indore, the same instrument was badly placed. Otherwise these two observatories were more satisfactory.

The Pachbudra observatory has been far from satisfactory, as was also the case in the previous year; and were it not that its suppression would leave the greater part of Western Rajputana, a region of especial meteorological interest, entirely unrepresented, I should have closed the observatory and withdrawn the instruments. The barometric registers of the past year are quite worthless.

The observatories, working under Mr. Hill's direction, *viz.*, Sutna, Nowgong, Sambhar, and Ajmere, are far more satisfactory. Mr. Hill mentions that the Sambhar observer sometimes makes mistakes, but these have been detected and eliminated in Mr. Hill's office, and the registers furnished by him are quite satisfactory.

Special allowances have been awarded to the following observers for the current year, on the recommendation of the Reporters. It appears, however, from Mr. Pearson's report, just received, that the claim of the Neemuch observer is doubtful, as he stands low on the list of merit.

Names.	Stations.	Amounts. Rs.
Har Nath	Sutna	5
(*) Ram Persad	Ajmere	5
T. Bachu	Neemuch	5
Ram Lall	Bickaneer	5

OBSERVATORIES IN THE BOMBAY PRESIDENCY.—The observatories, which contribute registers to this office, are the same as in the previous year, *viz.*:—

First Class.

Colaba.
Bombay.

Second Class.

Belgaum.
Poona.
Deesa.
Kurrachee.

Third Class.

Jacobabad.
Hyderabad.
Bhuj.
Rajkot.
Sholapur.
Surat.
Ratnagiri.
Karwar.
Malegaon.

The Colaba observatory is independent of the Department and only furnishes a register similar in form to those of Allahabad and Jeypore. The remaining stations are administered by the Reporter for Western India.

The four stations of the second class have all been inspected by the Officiating Reporter, Mr. Pearson. Excepting slight defects in the working of the anemographs, which the Reporter rectified, the observatories of Deesa, Poona, and Belgaum were found to be in good order. At Kurrachee, the observer practised an erroneous method of reading his barometer, which, however, when discovered, admitted of the recorded readings being corrected to true values.

Of the third class stations, Surat, Rajkot, Malegaon, Hyderabad (Sind), Jacobabad, Sholapur, and Ratnagiri were also inspected, and some notice of the results of each inspection are given in Mr. Pearson's Report (Appendix F).

Of these, the Ratnagiri observatory was the only one found to be in satisfactory condition, and properly worked. At Malegaon, the barometer was not vertical; at Surat the radiation thermometers were covered with a wire netting, and the observer misread his anemometer; at Jacobabad, the nocturnal radiation thermometer was read without being exposed, and had a divided column; at Sholapur, the barometer cistern was never adjusted and the instruments dirty; at Rajkot, the anemometer was out of order; and at Surat and Malegaon, Madras time, and at Sholapur, Bombay time, was observed instead of true local time. As all these practices are subjects of particular notice and special warning in the printed instructions furnished to all observers, their existence implies very reprehensible negligence on the part of the observers.

Before the receipt of Mr. Pearson's Administration Report, special allowances had been awarded to the following observers; those marked(*), this year, for the first time. Having regard to the circumstances above noticed, it is under consideration whether those granted to Narayan Mane and Dhunjibhai Mutabhai should not be reduced or withdrawn.

Names.	Stations.	Amounts. Rs.
Narayan	Jacobabad	10
Mahadev Cuddum . . .	Ratnagiri	5
Dhunjibhai Mutabhai . .	Surat	5
(*) Solomon Samuel . . .	Rajkot	5

OBSERVATORIES IN MADRAS, MYSORE, COORG AND HYDERABAD.—Of the three additional observatories, sanctioned in October 1881, one, *viz.*, at Kurnool, has been established during the past year, raising the number in these provinces to seventeen, which are as follow:—

Second Class.

Vizagapatam.
Bellary.
Trichinopoly.

Third Class.

Gopalpore.
Madras.
Madura.
Coimbatore.
Wellington.
Salem.
Negapatam.
Cochin.
Mangalore.
Bangalore.
Secunderabad.
Masulipatam.
Kurnool.
Mercara.

Vizagapatam is a private observatory, established by Mr. A. V. Nursingrow, who communicates its very excellent registers, as well as a daily telegram, to this office. The others, except Gopalpore, which is administered by the Bengal Office, are under the Meteorological Superintendent of the Government of Madras, whose Report on the Administration has not been received.

As far as can be judged, the work of the observatories has generally been satisfactory, but the communication of the work to this office is very greatly in arrear.

OBSERVATORIES IN BRITISH BURMA.—There are, as in previous years, eight observatories in this province—one, Akyab, under the direction of the Meteorological Reporter to the Government of Bengal; another, Diamond Island, which was established specially for storm-warning purposes, under the Central Office; and six under the immediate direction of the Sanitary Commissioner of British Burma. The total list is as follows:—

Second Class.

Rangoon.

Third Class.

Bassein.
Diamond Island.
Akyab.
Thyetmio.
Mergui.
Tounghoo.
Moulmein.

Lists of the Superintendents and observers are given in Appendices A, E, and G.

I have received no special report from the Sanitary Commissioner, on the condition of the six observatories under his administration. Rangoon is the least satisfactory of all the second class stations, almost every register received being full of errors, and it contributes less work than any other.

Bassein is another station that has been most unsatisfactory. As long as Dr. Baker was Superintendent, this observatory was one of the best in the province, and a special allowance was granted to the observer. But since his departure, the registers have greatly deteriorated, and towards the end of the year the special allowance was withdrawn. Since then, the observer has left.

The work of Tounghoo and Thyetmio has also been the subject of repeated complaint, and the only observatories under the Sanitary Commissioner that have fairly worked well, are those of Moulmein and Mergui. That of Diamond Island, where the Telegraph Master is observer, has been satisfactory, as far as can be judged from the registers; but that of Akyab is reported by Mr. Eliot to have been in a somewhat unsatisfactory condition during the past year, and to contrast most unfavourably with Cuttack, Dacca and Saugor Island, at which, as at Akyab, the Telegraph Master is the observer.

The only observer in the province to whom a special allowance has been allotted for the current year is—

Name.	Station.	Amount.
		Rs.
P. H. Hilbert	Moulmein	5

OBSERVATORIES AT THE BAY ISLANDS.—These as in former years are two, *viz.* :—

Third Class.

Port Blair (Andamans).
Nancowry (Nicobars).

The names of the Superintendents and observers are given in Appendix E.

The Port Blair Observatory, a very important one, in virtue of its position, has continued to furnish very good work. That of Nancowry has been less satisfactory, the registers having been returned on several occasions for the correction of errors.

The special allowance, awarded last year, to the Port Blair observer has been renewed for the present year:—

Name.	Station.	Amount.
		Rs.
J. F. Peters	Port Blair	5

EXTRA INDIAN OBSERVATORIES.—The list of extra Indian observatories comprises one less than that given in last year's report, owing to the withdrawal of the British Resident's establishment (and therewith the observatory) from Gilgit. And, on the other hand, the two observatories that have been established during the year at Kailang in Lahoul, and in the Seychelles, did not contribute registers during the year under report. The former of these is, however, more properly a Punjab observatory, and will be so classed in future reports. The list for the past year then stands as follows:—

Second Class.

Leh. | Aden. | Zanzibar.

Third Class.

Bushire.
Quetta.
Katmandu.
Amini Divi.

Leh transmits its registers to the Punjab Reporter; Zanzibar to the Reporter for Western India; and the remainder, excepting Amini Divi, to the Central Office in Calcutta. The registers of Amini Divi have been sent to the Madras Office, from which, as yet, I have been unable to obtain them, so that they do not appear in the annual reports of the Department. The names of the Superintendents and observers are given in Appendices C II, E and F II.

In addition to the above, reports are received from the observatory at Goa, which is superintended by Señor Antonio Martins. This has been visited, during the year, by Mr. Pearson, the Officiating Reporter for Western India, and some notice of it will be found in his Report, Appendix F.

The work of the Leh Observatory has been as satisfactory as in former years, and that of the Aden Observatory has shown but few errors. That of Zanzibar has suffered a partial interruption, owing to the observer having been committed to jail; but the continuity of the most important part of the registers was preserved by the exertions of the Superintendent, Dr. Bartholomeux, who, himself, registered the more important instruments during the sequestration of his subordinate.

The registers of Bushire have preserved their usual excellence, and those of Quetta have shown much improvement. But the observatory at Katmandu has been less satisfactory, the barometric registers from August to December having shown an amount of discrepancy, which renders them useless.

The registers of rainfall statistics and marine meteorology have been already noticed in the introductory portion of this report.

INSTRUMENTS.

In Appendix H, is given a return of the instruments in store at the beginning of the year, and of those received and issued by the Calcutta Meteorological Office. This list includes the stock receipts and issues of the Alipore Observatory; and, in Appendix I, a return of the instruments issued to each observatory.

METEOROLOGICAL OFFICERS AND OFFICE WORK.

The general control of the meteorological observatories and offices in the different provinces, with the local exceptions noticed in the foregoing sections, has been in the hands of the following officers during the year :—

Province.	Superintending Officers.	Names.
Bengal and Assam	Meteorological Reporter, Government of Bengal	John Eliot, M.A.
North-Western Provinces and Oudh	Meteorological Reporter, North-Western Provinces and Oudh	S. A. Hill, B.Sc.
Punjab	Meteorological Reporter, Punjab	Surgeon E. Lawrie, M.D.
Central Provinces	Sanitary Commissioner	Deputy Surgeon General B. Simpson, M.D.
	Meteorological Reporter, Government of India	H. F. Blanford, F.R.S.
Berar	Sanitary Commissioner	Dr. Little.
	Meteorological Reporter, Western India	F. Chambers. Surgeon W. Nolan, M.D. A. N. Pearson.
Central India and Rajputana	Meteorological Reporter, North-Western Provinces and Oudh	S. A. Hill, B.Sc.
	Meteorological Reporter, Western India	F. Chambers. Surgeon W. Nolan, M.D. A. N. Pearson.
	Meteorological Reporter, Government of India	H. F. Blanford.
Bombay	Meteorological Reporter, Western India	F. Chambers. Surgeon W. Nolan, M.D. A. N. Pearson.
Madras	Meteorological Superintendent, Madras	Miss Isis Pogson.
Burma	Meteorological Reporter, Government of Bengal	John Eliot, M.A.
	Sanitary Commissioner	Dr. D. Sinclair, M.D.
	Meteorological Reporter, Government of India	H. F. Blanford.
Bay Islands	Senior Medical Officer, Port Blair	Surgeon J. Reid, M.B.
	Meteorological Reporter, Government of India	H. F. Blanford.
Extra Indian Observatories	Meteorological Reporter, Punjab	Surgeon E. Lawrie, M.D.
	Meteorological Reporter, Government of India	H. F. Blanford.
	Meteorological Reporter, Western India	F. Chambers. Surgeon W. Nolan, M.D. A. N. Pearson.
	Meteorological Superintendent, Madras	Miss Isis Pogson.

Mr. F. Chambers was absent on sick leave from the 6th June 1882, from which date to the 17th July, Surgeon-Major W. Nolan held charge of the appointment. During the remainder of the year Mr. A. N. Pearson officiated as Meteorological Reporter for Western India, and has performed its duties in a very satisfactory manner.

In the other provinces, the permanent incumbents have remained in charge of their respective offices.

The following table shows the number of stations, the registers of which were sent to each of the Reporters respectively, for reduction and verification, during the year under report :—

PROVINCES.	METEOROLOGICAL REPORTERS.						TOTAL.
	India.	Bengal.	North-Western Provinces and Oudh.	Punjab.	Western India.	Madras.	
Bengal and Assam	3	20	...	...	...	...	23
North-Western Provinces and Oudh .	1	...	15	...	...	...	16
Punjab	...	...	...	11	...	...	11
Rajputana and Central India . .	1	...	4	...	4	...	9
Central Provinces	11	...	...	...	...	...	11
Berar	1	...	...	...	4	...	5
Bombay	...	...	...	...	14	...	14
Madras, Mysore, and Coorg . .	1	1	...	...	...	15	17
Burma	7	1	...	...	...	...	8
Bay Islands	2	...	...	...	...	...	2
Extra Indian	5	...	...	1	1	1	8
TOTAL .	32	22	19	12	23	16	124

This list does not include the registers of the Colaba observatory, of Goa and Jeypore, which are furnished to the Meteorological Office with all the necessary reductions.

In Bengal and the North-Western Provinces, the Meteorological Reporters superintend also the numerous rainfall registers of the district and sub-divisional stations of their respective provinces, and prepare weekly or monthly returns of the rainfall ; and in Bengal and Bombay, the Reporters have also charge of a system of daily reports, received by telegraph ; in the case of the former, (up to the end of the year under report) from fifteen, in that of the latter from ten stations. The Meteorological Reporter for Bengal also administers the newly established department of the Central Office, for the purpose of collecting cotemporary records of the meteorology of Indian seas.

The staff of gazetted officers has been increased, during the past year, by the appointment of Mr. W. L. Dallas, as Scientific Assistant to the Meteorological Reporter to the Government of India. The special duties, for which Mr. Dallas has been appointed, are the preparation of the daily reports, and also of bi-monthly and half-yearly reports on the weather; in general terms, to extend and improve the circulation of current information on the weather, and also the reduction and discussion of the meteorological data for Indian seas, which have been received from the Marine Department of the London Meteorological Office. Mr. Dallas has been for ten years on the staff of the London Office, and has a familiar acquaintance with the work of preparing daily weather reports, according to the system there practised ; and before leaving for India, he was placed on special duty for two months, in order to acquaint himself with the work of the Marine Department of that office. He arrived in India, therefore, already furnished with the practical knowledge necessary to enable him at once to assume charge of his duties, requiring only such occasional assistance and guidance as might be necessitated by the change of local conditions, and by his having to deal with a system of tropical meteorology. This additional knowledge he is now rapidly acquiring, and I have every reason to be satisfied with the aptitude and intelligence he has displayed, in adapting himself to the requirements of his present office.

OFFICE ESTABLISHMENTS.—The following is a return of the number of permanent employés in the offices of the several Meteorological Reporters, as far as information has been received up to the end of the year under report :—

	India.	Bengal.	North-Western Provinces.	Punjab.	Western India.	Madras.	TOTAL.
Head clerks	1	1	1	1	1	1	6
Computers	3	...	4	1	6	2	40
Clerks and copyists	3	2					
Tabulators	16[1]	3					
Draftsmen	3	...	..	...	...	...	3
Artisans	...	3	...	...	...	...	3
Peons and menials	10	4	1	1	1	1	18

During the past year, the office of the Meteorological Reporter for India has been under the management of the Head clerk, Babu Fanindra Mohun Basu, and with the same very satisfactory results as in former years. Since he has been relieved of the double duty of superintending both the offices for India and Bengal, he has, I am glad to say, enjoyed better health, and has not been obliged to absent himself for any prolonged period from his office duties.

Two clerks and a draftsman were added to my office at the beginning of the year, for the purpose of dealing with the meteorological logs from the Bay of Bengal, of which Mr. Eliot has undertaken the collection, and this portion of the establishment is under his control.

In February, a further addition to the office of a temporary establishment of four tabulators was made, for the special purpose of the reduction of the marine data of past years. This portion of the establishment is under the immediate direction of Mr. Dallas.

Some additions have been sanctioned to the office establishments of the Reporters for the North-Western Provinces, the Punjab, and Madras, but these did not take effect until after the close of the year.

WEATHER BULLETINS AND STORM SIGNAL SERVICE.—The daily weather bulletins were issued at Simla from the 16th May 1882 to the 15th October, and at Calcutta during the remainder of the year. The verbal remarks which, in previous years, have formed part of the report only in the Simla issue, continued to appear during the last year, after the place of publication was transferred to Calcutta, and will henceforth invariably accompany the tabular matter. A telegraphic abstract of these remarks is forwarded daily to the Governments of Bengal, North-Western Provinces and Oudh, Bombay, Madras, Assam, Central Provinces, and British Burma; the Meteorological Reporters of Bengal, North-Western Provinces and Oudh, and Western India; the Director of Agriculture and Commerce, North-Western Provinces; the Port Officer of Madras, and the Government Astronomer of Madras.

A summary of the weather characteristics of the monsoon season of 1882 (May to October) was drawn up by Mr. Dallas, and published in the *Gazette of India* on the 13th

---

[1] Besides these there are four temporary clerks for reducing Meteorological Office Marine logs.

January 1883, and that of six months, November 1882 to April 1883, was issued in the Gazette for the 2nd June 1883.

The improvements, introduced by Mr. Eliot, in the working of the storm signals of Calcutta and in the daily weather reports issued by his office, have already been noticed in the first part of this report, and further details will be found in the Administration Report for Bengal (Appendix A).

The subject of the storm-warning service in Bombay has also been noticed in the introductory portion of the report, and the subject is noticed at length in Mr. Pearson's Report (Appendix F). No daily reports are published by the Bombay Office.

ANNUAL REPORTS.—The Report on the Meteorology of the year 1881 was completed and in the printer's hands before the end of December 1882, and it was submitted to Government in its complete form on the 18th June 1883. The printing of the text had been completed about two months earlier, but the issue was somewhat delayed by the plates being somewhat behind hand. Arrangements will be made this year to endeavour to effect an earlier issue.

The report gives tables of temperature for 131 stations and rainfall returns for 417 stations, being an increase of five of the former and eighteen of the latter, on the numbers respectively summarised in the corresponding tables of the report for 1880. The returns of pressure, wind direction, and other meteorological elements are nearly as numerous as those of temperature; and registers of the temperature of the ground are given for four stations, against two in 1880. The elements tabulated in the Appendices are as follow. I give for comparison the number of registers summarised in the corresponding tables of the report of the four previous years :—

	NUMBER OF STATIONS.				
	1877.	1878.	1879.	1880.	1881.
Equilibrium temperatures of solar radiation	95	99	106	109	106
Temperature of nocturnal radiation	95	97	100	108	106
Temperature of the ground	...	...	...	2	4
Mean and extreme air temperatures	108	116	123	126	131
Sea-level equivalents of mean temperature	94	100	101	105	108
Means and extremes of atmospheric pressure	106	113	119	122	125
Sea-level equivalents of mean atmospheric pressure	93	96	98	105	107
Direction and movement of winds	109	113	118	124	127
Temperature of evaporation	99	106	111	115	121
Tension of atmospheric vapour	106	113	120	123	128
Mean relative humidity	106	114	120	123	128
Mean proportion of clouded sky	104	110	118	122	125
Inches of rainfall in each month	311	353	365	399	417
Number of days on which rainfall was measured	239	276	365	379	403

The descriptive letter-press discusses the meteorology of the year in detail. It includes 29 numbered tables, giving the average values of all the more important elements, for all stations that have forwarded returns for three years and upwards; and the report is illustrated with nine plates; one of which is a chart showing the positions of all observatories and raingauge stations; three, in coloured lithography, represent the distribution of temperature, pressure and winds in each month of the year; and the remainder illustrate particular phases of the weather, *viz.*, the conditions which precede and accompany the rainfall of the cold weather and early spring; the setting in of the monsoon rains in Bengal; the formation of the Kathiawar cyclone, that of barometric depressions on the Gangetic plain; and the Madras cyclone of November 1881.

The original observations at six stations in India, *viz.*, Calcutta, Lucknow, Lahore, Nagpur, Bombay, and Madras, were issued in monthly parts as a distinct publication and form a small quarto volume, the third of the series, prefaced by a detailed description of the stations and the instruments employed. The final sheets of the registers for 1881 were issued in November 1882.

Mr. Hill has also published, independently, a summary of the observations of the observatories which he superintends, and the registers of which are verified and reduced in his office, and Mr. Pearson, the Officiating Reporter for Western India, prepared for the Bombay Government a sketch of the meteorology of the Bombay Presidency in 1881, which was printed in pamphlet form.

Miscellaneous publications.—The first edition of the *Instructions to Observers,* forming the first part of the *Indian Meteorologist's Vade Mecum*, having been exhausted, a new and revised edition was prepared and printed during the past year. This work, being the official guide for Superintendents and observers, is more or less in constant demand for the use of the Department.

One part of the Indian Meteorological Memoirs has been issued during the year, forming the first part of volume II. It contains a memoir, by Mr. J. Eliot, on a cyclone in the Bay of Bengal in September 1878, and a list of the recorded cyclonic storms on the coasts of Bombay and the Arabian Sea by Mr. F. Chambers. Both these have been noticed in the introductory portion of this report. Part II, containing papers by myself and Mr. S. A. Hill, is in the press and will be issued in the course of a few weeks.

Mr. Eliot has in hand a discussion of the storm, that occurred in October 1882, in the Bay of Bengal, and although not severe, brought very heavy rain to the greater part of Bengal; also a discussion of all the storms which occurred in the Bay of Bengal during the period 1875 to 1880, of which records exist in the office. Mr. Pearson has written a paper entitled "A contribution to the study of the transmission eastwards round the globe of barometric abnormal variations," and has tabulated for discussion the data of a number of ships' logs relating to storms on the Arabian Sea.

Some other work in hand, including the rainfall chart of India, the reduction and discussion of the marine logs relating to Indian seas, &c., have been noticed at length in the introduction.

A comparative return of the rainfall of India, in 1882, with illustrative charts, was prepared and submitted to Government for communication to the Secretary of State on the 30th March 1883.

Appendix K gives a list of the Government officials, offices, libraries, societies, &c., to which the publications of the office are presented, including those which furnish their own publications in exchange.

LIBRARY.

The library is contained in six large double book-cases and is in excellent condition. An alphabetical catalogue of the bound volumes has been made by Mr. Dallas. The list of additions to the library during the past year is given in Appendix L.

HENRY F. BLANFORD,
Meteorological Reporter to the Government of India.

SIMLA:
The 2nd August 1883.

APPENDIX A.

Extracts from the Administration Report of the Meteorologicl Reporter to the Government of Bengal for the year 1882-83.

DURING the official year, 1882-83, meteorological observations were taken regularly at one first class observatory, seven second class observatories, and twelve third class observatories in the provinces of Bengal and Assam. An additional third class observatory was established at Tura in the Garo Hills in the month of March 1883.

During the year, a series of changes was sanctioned by the Bengal and India Governments for extending the work of observation of the Department, and for improving the publication of the meteorological data collected by the Department for the information of the Government of Bengal, district officers, and the general public. As these changes very considerably extend and modify the Department under my charge, it appears desirable to place on record a full statement of the reasons for the changes, and an account of the circumstances under which they were made.

The origin of the proposals was a demi-official letter which I received from the Secretary to the Government of Bengal, Revenue Department, Mr. A. P. MacDonnell, on the 11th of August. In this, he pointed out that the meteorological information published in the Gazette was not sufficient for the wants of the Bengal Secretariat, and asked if I could not arrange to publish weekly in the Gazette the meteorological observations taken over the province during the preceding week, together with a statement in which the more important meteorological features of the week should be clearly and prominently brought to the notice of Government and district officials. The attention of the Government of Bengal was particularly directed to the meteorology of Bengal and the working of the Bengal Meteorological Department at this time, by the unusual lightness of the rains in Northern and North-Eastern Bengal. It was so serious, at one time, as to suggest the probability of a partial failure of the crops. The daily reports, issued by the Meteorological Reporter to the Government of India, gave very little information respecting this part of Bengal, and threw no light on the meteorological conditions of the district. The returns, sent in to me by post, and tabulated in the ordinary routine of the work of a small office, did not show until later that, although the rainfall was deficient and abnormal in character, this was due mainly to lightness of the rain showers and not to any diminution in the number of rainy days or in the amount of cloud. I replied to Mr. Secretary MacDonnell's letter on the 13th of August, admitting that the Bengal Meteorological Department was, in comparison with similar Meteorological Departments in European countries and the United States, very much behind hand in utilising and publishing for the public benefit the meteorological data it collected. I pointed out that this part of the work of the Department, "Economic Meteorology" as it might be termed, appeared to me to be of primary importance in India, and added that I should be willing, if the means were placed at my disposal, to use my utmost efforts to propose and establish an effective provincial meteorological system, which should collect, tabulate, and publish, at frequent intervals, the results of the observations taken throughout the province, at a sufficient number of stations, to represent its more important meteorological conditions and changes adequately, together with a comparison of the current atmospheric conditions in Bengal, with the normal meteorological conditions of the province; and to trace out, so far as I could, the connection between these variations in the elements of meteorological observation, with the variations in the distribution of rainfall throughout the year. I also indicated, roughly, the more important changes it would be necessary to make, in order to establish and develope a provincial system of meteorological observation, which should keep the Government fully informed of the present meteorological conditions of the province and their variations from the normal conditions. Mr. Secretary MacDonnell replied demi-officially to this on the 29th of October, stating that I had correctly estimated and described what was required to improve the meteorological information supplied by my Department, and that the Lieutenant-Governor approved the objects aimed at, and the general outline of the proposals I had suggested to secure these objects, and requested me to come up to Government officially on the matter, and submit my proposals with the necessary fulness, and to state the modification it would be necessary to introduce into the existing establishment and practice of the Department.

I spent a part of the college cold-weather vacation in collecting information, and finally submitted my proposals to the Government of Bengal on the 29th of December. The following extracts (with some slight modifications and change of verbal expression) will indicate the objects aimed at, and the character of the proposals :—

"The Meteorological Departments in India ought to carry out two objects differing considerably in character and value. The first is that of contributing a share towards the advancement of meteorology as a science, *i.e.*, of the determination of the exact relations which subsist between the various atmospheric conditions and changes and the effective causes or actions. India is the only tropical country which possesses a fairly complete and satisfactory meteorological system for this purpose. It also presents, from its geographical position, many unique meteorological conditions and features of great scientific interest and value. It is thus qualified to play a very important part in the progress of scientific meteorology. This it can do, by collecting and publishing accurate observations, taken under suitable conditions, and also by discussing them in a scientific manner, and distributing the results of its investigations to meteorologists over the world. This appears to me to be the work to which the Meteorological Reporter to the Government of India and his Scientific Assistant (lately appointed) are mainly devoting themselves, and to which they make the local reporters subservient. It is evident that it is immaterial whether the relations they are in search of are determined from observations of a day or a century ago, provided they are known to be accurate and reliable, and the investigations are exact. Rapidity in the collection and discussion of the observations is obviously not desirable, and might be dangerous, as leading to hasty and perhaps erroneous conclusions.

"The second object of the Meteorological Department is less important from a scientific aspect, but is of supreme importance economically in a country like India, which is dependent for its prosperity almost entirely upon its agricultural resources and productions ; and where the fluctuations of rainfall are so great, as to subject a large part of the country to the occasional occurrence of prolonged drought and intense famine. This second branch of meteorological work in India is to publish, for the information of the Government, and all others directly interested in it, frequent statements of the present meteorological conditions of the country and its variation from the average conditions, and, so far as is possible, anticipations of any impending important atmospheric disturbance. This it can only do by the rapid and continuous collection, tabulation, and discussion of the observations taken at the various reporting stations. This continuous consideration of the weather, as it is at the present moment, will alone furnish the experience, methods and instincts necessary to consider it as the invariable antecedent of the weather to come. This will gradually lead up, in the case of Indian meteorological enquiry, to the true test and the ultimate aim of every science—prevision more or less perfect. An early step in such a direction, for example, would be to previse the general character of the distribution of the monsoon rains, from the atmospheric conditions of the preceding hot-weather months. This, which may be termed "economic meteorology" in opposition to the first or "scientific meteorology," is of as great importance to the Local Governments as to the Imperial Government. It is included in the programme of the Meteorological Reporter to the Government of India. The publication of his daily weather report supplies sufficient information to satisfy the present requirements of the Government of India. But this report is published at too frequent intervals for the guidance of officials in Bengal, the remarks are very brief and general, and are especially defective in the most important point, *viz.*, the distribution of rainfall in each province, more especially during the south-west monsoon, and are practically of no great value for the information and guidance of the Government of Bengal. This branch of meteorological work in India was the subject of special recommendation by the Famine Commissioners, as is shown by the following quotation (*vide* Report, Part I, paragraph 40) :—

" 'Within the last few years a very satisfactory system of meteorological observations has been established all over British India, and in our opinion it is of primary importance that it shall be maintained in complete efficiency, and shall so far be strengthened and improved, as to ensure the early and punctual supply of information to the Executive Governments, and to the officials in all departments concerned with the agriculture of the country, or the preparations required to meet famines, as to the actual progress of the periodical seasons of rain in all parts of the provinces, for which those Governments or officers are respectively responsible. So far as it may become possible, with the advance of knowledge, to form a forecast of the future, such aids should be made use of, though with due caution.'

" This early and punctual supply of meteorological information is moreover, as General Strachey pointed out to me a few years ago, that part of meteorological work which the Local Governments ought not merely to encourage, but to promote, and which is more especially the province of the Local Reporters as opposed to the Imperial Reporter.

" The work proposed to me to carry out is identical in its general character with that stated by the Famine Commissioners to be one of the most important duties of the Meteorological Department, *viz.*, the early and punctual supply of accurate meteorological information to the Executive Government and district and other officials. The extensions that I desire to submit to the Government of Bengal, have this solely for their object. They provide for the daily submission of observations, taken at 10 A.M., at 38 stations, distributed throughout the province, and of rainfall returns from about 156 additional stations, and for their rapid continuous reduction, tabulation, and discussion in the Bengal Meteorological Office. The complete rainfall returns of the province, I propose, shall in future be considered at the same time and in conjunction with the meteorological observations. This will be effected, by linking to each meteorological observatory, the adjacent rainfall recording stations. By this mode of treatment, I hope to determine all the more important meteorological features of each district, which will thus be represented by a group of one or two observing stations and several rainfall stations. In this way, more especially, the amount, distribution, and variation from the mean, of the rainfall throughout the province, can be approximately gauged week by week, month by month, or season by season, and be recorded in the speediest and most exact manner for the information of Government.

" The present meteorological system, established in Bengal, appears, with the above objects in view, to be defective in the following respects :—

" *1st.*—The stations are too few in number to represent adequately the province of Bengal. They are, in all, fourteen stations for the whole of Bengal, Behar, Chutia Nagpore, and Orissa, including an area of 205,000 square miles. Of these stations, two—False Point and Saugor Island, on the seaboard—are maintained solely in connection with the Calcutta Storm Signal Service. The province of Bengal, occupying an area nearly twice as large as the British Islands, is represented meteorologically, for agricultural and economic purposes, by only twelve stations. The weekly agricultural and weather report of the British Islands, published by the English Meteorological Office, is based on the meteorological returns of 66 stations, and I am informed that even that number of stations is considered insufficient. In making this comparison, I do not wish to assert that observing stations should be as thickly spread in India, as in England, to give the same extent of information of weather conditions and changes. The weather in Bengal is undoubtedly much more uniform than in the British Islands. Irregularities of atmospheric conditions are also usually of a much simpler and more persistent character. Even taking these facts into consideration, it appears to me that Bengal is by no means sufficiently represented by its present twelve meteorological stations.

" *2nd.*—The present observatories are by no means equally distributed throughout the province. Large and important districts, from an agricultural point of view, are almost, if not entirely, unrepresented. The most glaring example of this is Northern Bengal. The whole of the Bengal plains to the east of Purneah, and to the north of Berhampore, Jessore, and Dacca, comprising, I believe, the entire jute-producing districts of India, does not possess a single observatory. The more eastern districts are to a certain extent represented by Dhubri and Silchar. It appears, however, not too much to assert that Northern Bengal as a whole is unrepresented in our meteorological system at the present time. Similarly, the whole of the southern districts of Chutia Nagpore, and the Midnapore and Balasore districts, are outside the range of observation of the existing stations.

"*3rd.*—The present system of twelve stations, which, even if it were in perfect order, would be insufficient to represent Bengal, is really, in consequence of a third defect, less efficient than it appears. Native observers, in consequence of their imperfect scientific instincts, and of the very slight scientific training given in Indian schools and colleges, are frequently inaccurate. And even if they have been carefully trained, many of them are liable to lapse into careless and erroneous methods. Frequent inspection at unexpected times, and more especially when the returns themselves indicate errors, more or less continuous, is an absolute necessity. Yet this, under the present system, is an impossibility in Bengal. I am bound down to Calcutta without a day's intermission for practically ten months of the year, by the combination of my college duties, my storm signal and daily weather report work, and by the charge of the India Weather Office during the absence of the Reporter to the Government of India in Simla. I can only leave Calcutta, on inspection duty, for a short period during the cold season. Defects, observational or instrumental, may hence be prolonged for months, and even years, without detection. This defect is a very serious one. Each succeeding year's tour of inspection impresses it upon me more strongly.

"*4th.*—The present mode of collecting, reducing, and discussing the meteorological observations is dilatory and unsatisfactory. If the sole object of the Department were the collection and publication of accurate observations for the information of European Meteorologists, it would be unobjectionable. As pointed out by the Famine Commissioners, early and exact meteorological information is at all times valuable to the Government and district officers of Bengal, and occasionally it is a pressing necessity; and yet it is hardly too much to state that the Bengal Reporter can furnish to the Provincial Government fuller and later information of the meteorology of any portion of the British Islands than he can of the greater part of Bengal. It is not necessary to state fully the causes of this. It is sufficient to state that the present system has tended to centralization rather than to development: hence it is the Government of India that has mainly profited by the recent changes. The Provincial Government of Bengal is not as yet furnished with the early and punctual supply of meteorological information which it requires.

"The proposals aim at the removal of the defects enumerated in the preceding paragraphs, and at the carrying out of the object proposed :—

"*1st*—By the establishment of additional observatories.
"*2nd*—By the extension of the work of inspection.
"*3rd*—By the increase of my office establishment.
"*4th*—By frequent publication of returns.

"I propose, in future meteorological reports and discussions, to divide Bengal into seven areas, each of which will be a fairly homogeneous area, and differ from the others in its meteorological features, more especially the amount and distribution of its rainfall. Each of these areas will be represented by three to seven observing stations, giving all the meteorological features, except rainfall, with sufficient fulness for present purposes. The rainfall will be determined by these observing stations and the 156 additional rainfall recording stations, three to five of which will be linked to each observing station, so as to enable the rainfall of the district, represented meteorologically by the observing station, to be approximately determined.

"The seven meteorological areas I propose are—

"*1st*—Orissa.
"*2nd*—South-West Bengal, including the Burdwan and Presidency Divisions.
"*3rd*—East Bengal, including the Dacca and Chittagong Divisions.
"*4th*—North Bengal, including the Rajshahye and Cooch Behar Divisions.
"*5th*—North Behar, including the districts of Behar north of the Ganges.

"*6th*—South Behar, including the districts of Behar south of the Ganges.

"*7th*—Chutia Nagpore.

"In order to assign an adequate number of observing stations, it will be necessary to increase the present number very considerably. This I propose to effect through the agency of the Public Works Department, which has been most freely offered for the extension. I am informed by Major Neill, Assistant Secretary, Public Works Department, that observations are taken at Buxar, Arrah, and Dehree, and that they could be taken at a large number of stations by overseers. These men are specially qualified, by their training in surveying, to read such instruments as the barometer, and would make valuable observers.

"The following are the stations, which I have selected from the list given me by Major Neill, where observatories could be established and the work of observation properly carried on, through the agency of the Public Works Department :—

Motihari.
Ranchi.
Chyebassa.
Balasore.
Midnapore.
Raneegunge.
Nya Doomka.
Bhagulpore.
Julpigori.
Rungpore.
Dinagepore.
Serajgunge.
Mymensingh.
Furreedpore.
Commillah.
Noakhally.
Burrisal.
Rampore Baulia.
Chupra.

"These, with the two stations of Buxar and Dehree, would give 21 additional observatories. This extension will necessitate the immediate erection of 19 observing sheds.

"The Public Works Department, in making the offer of the services of these overseers as observers, did not contemplate that they should receive any remuneration, and I am not therefore prepared to urge upon Government its absolute necessity. On the other hand, a small monthly allowance will not only give them a tangible interest in their meteorological work, but also furnish me with some hold upon them, for the proper performance of their meteorological duties. There would thus be a reasonable probability of the additional observations being fairly trustworthy and accurate, and equal in value to those taken at our present observatories. My past experience shows that this would almost certainly not be the case if this additional work (not a part of their recognised duties) were imposed upon them without any remuneration. The monthly allowances would be granted, conditional upon the punctual and accurate performance of their meteorological duties during the month, as tested by the returns received from them in my office. As the work would be less than at our present third class observing stations, I would suggest that these fourth class observers be granted allowances of ten rupees monthly. This will necessitate a yearly grant of Rs. 2,520. If these proposals be sanctioned, they will, I believe, give the Department the increased power of observation, which appears to me necessary, in the most effective and economical manner possible, and will remove almost entirely the first and second defects of the present system.

"As my meteorological duties are increasing year by year, I am unable to suggest any feasible plan which will enable me to inspect the observatories at any time throughout the year, whenever it may appear desirable or necessary. I would therefore suggest the appointment of a native inspector on Rs. 50 rising to Rs. 60 per mensem. It will be possible, for this amount, to obtain the services of a man who has been trained at the Seebpore or Roorkee Engineering College in the use of instruments, and has learnt to draw and chart neatly. He would supply a double want in the Bengal Office. Whenever the returns received indicated continued instrumental or observational defects at any station, he would be sent there to ascertain the causes of the errors, and thus enable me to remove them without unnecessary delay. When in Calcutta, he would be employed in preparing the various charts that will be required to enable me to prepare the weekly reports. He would also be very useful, during the first year of the extension, in teaching the new observers of the Public Works Department their meteorological duties. As I do not propose to diminish my own work of inspection during the cold weather, which I consider indispensably necessary to the maintenance of the stations in a state of efficiency, it will also be necessary to provide for the travelling expenses of the native Inspector. These, I estimate, will not exceed Rs. 400, which I would therefore ask Government to sanction in addition to his pay."

I have already stated that, in future, it appears to me desirable the rainfall returns should be considered and discussed in connection with the meteorological observations. The first essential for early publication of meteorological results is rapid transmission of the observations to the central office. Hence, in all cases where it is possible, the 10 A.M. meteorological observations will be despatched to Calcutta by weather telegrams. At those observing stations where there is no telegraph office, the 10 A.M. observations, taken daily, will be sent by the first dâk after each observation to Calcutta, by means of postal cards. The observations will be reduced and tabulated in my office as they arrive. Of the 38 stations under the extended scheme, 29 can communicate by telegraph at the present time; and with the probable early extension of rail and telegraphic communication to Jessore, Burrisal, Mymensing, and Chutia Nagpore, the number will increase, so that, in a few years, a fairly complete daily weather report for the whole province may be prepared from the weather telegrams. The majority of the stations which can communicate with the central office by post only, are in Eastern Bengal; and hence the information of that part of the province will be for some time more imperfect and behind hand than for the remainder of this province.

All rainfall-reporting stations will send in a daily return of rainfall, by means of postal cards. They will also, in all cases, submit a weekly rainfall report by post-card, as a check on the daily returns, in which mistakes from carelessness or haste may occasionally arise, or which may, in a few cases, be lost in postal transmission.

Those sub-divisional stations, which are at a greater distance than 48 hours dâk from Calcutta, will telegraph either directly or from the nearest telegraphic station, (for which special arrangements in each case will be made), with the object of completing the daily returns included in the weekly rainfall report to be published in future in the Gazette.

It will therefore be seen that I propose to receive the various returns, in all cases, direct from the observing officers, and not, as at present, in the case of rainfall returns, through the medium of a superior officer, as, for example, the Collector, the Civil Surgeon, &c. The delays in the submission of the rainfall returns under the present system, are in some cases excessive, and are due to the transmission from the recording officers, through other officials, not directly interested in the rapid collection of the information. Of course, if it be desired, there is no reason why the Collectors, Civil Surgeons, &c., should not receive a copy of the rainfall returns sent in direct to me. If this part of the scheme be adopted—and it is the only means I can suggest for effecting the continuous rapid transmission of the necessary returns to my office—it would be very desirable that the Government of Bengal should issue a circular to the sub-divisional and other rainfall-recording officers, requesting them to carry out fully and exactly the instructions I shall issue for the transmission of their rainfall returns, and if judged desirable and unobjectionable, permiting me to place myself in direct communication with them in order to call attention to probable errors of observations or delays in transmission.

From the 15th of May to the 15th of November, a period which includes the whole of the south-west monsoon rain in Bengal, it is proposed to publish a daily weather report containing the observations taken at 10 A.M. and transmitted by ordinary or urgent weather telegram to Calcutta, together with a short summary of the more prominent features of the weather, its deviation from the normal weather of that day by a comparison with the average pressure and temperature of the day, and the important changes of the previous 24 hours, with, bye-and-bye, anticipations of the weather throughout the province during the next 24 hours. This will be printed at the Secretariat Press by 6 P.M. each day, and sent by post to Government officers, district officers, and to certain officers of the Public Works Department. It is also proposed to publish, weekly, in the Gazette, two meteorological returns. The first will give the averages or totals of the elements of meteorological observation at the 38 reporting stations, and the average rainfall of the districts, represented meteorologically by each station, together with the variations of the pressure, temperature, and rainfall from the means for the period. The second return will give the daily rainfall at all the sub-divisional stations for the preceding week, and from which the average rainfall of the districts given in the other return will be derived. A summary will also be given, generally similar in character to the weekly agricultural weather report issued by the English Meteorological Office. In this the important features of the weather will be brought to notice, and the distribution of rainfall with respect to time and place, and its variation from the normal rainfall, will be fully worked out.

In addition to this, it is also proposed to publish in the Gazette, for more general reference, the usual monthly averages of the elements of meteorological observation for the 38 observing stations, and the average rainfall of each district for the month, together with a short summary, stating briefly the more marked peculiarities of the meteorology of the month. A return will also be published in the beginning of every month, giving the daily rainfall of the 162 sub-divisional stations for the preceding month. This will be to a large extent a reproduction of the weekly rainfall returns, but it will contain all returns not received in time to be included in the corresponding weekly reports. Also any errors which may be detected, during the month, in the printed weekly rainfall returns will be eliminated, so that the monthly rainfall return will be the final, complete and corrected publication of the rainfall for the period in question.

Forms, embodying these objects, have been drawn up and submitted to the Government of Bengal. They have been accepted after a few modifications, and will be adopted for the present, and until experience of the working of the new scheme shows what improvements it may be desirable to make in them.

The extensions which I proposed supplemented the existing arrangements, and I had consulted with the Meteorological Reporter to the Government of India, who approved generally of the scheme. As the Meteorological Department is on the Imperial Establishment, it was necessary for the Government of Bengal to submit the proposals to the Government of India for sanction, and to indicate the sources from which the additional expenditure was to be met. This was done in Mr. Secretary MacDonnell's letter No. 294—68Mis. (F), dated the 29th January 1883, to the Government of India, Revenue and Agricultural Department, in which he stated that, "finding the present Bengal meteorological reports inadequate for the purpose of administration in this province, the Lieutenant-Governor called on Mr. Eliot to prepare and submit a scheme calculated to afford this Government that detailed information regarding the meteorological conditions of all parts of this province, of which it now feels the want. This scheme Mr. Eliot submits in the papers herewith forwarded, and the Lieutenant-Governor requests that His Excellency the Governor General in Council may be moved to sanction the adoption experimentally of Mr. Eliot's proposals in this presidency. It will be observed that the proposals now submitted are purely supplementary of existing arrangements, (which they in no way modify), and may be at any time annulled without any disturbance of the latter. The entire cost of the improvements will fall on Provincial Revenues. I am to add that any conditions as to control, &c., the Government of India may think it, in the interests of the Imperial Meteorological Department, necessary to impose, will be readily accepted by this Government."

The Government of India replied that it was willing to accept these proposals, and sanctioned the scheme which had been prepared with so much care by the Meteorological Reporter to the Government of Bengal. It was further stated that "such control as may be necessary will, in the interests of the Imperial Meteorological Department, be most conveniently exercised by the Meteorological Reporter to the Government of India. In view of this object, the Government of India considers that the cost of the scheme should be treated as a contribution from Provincial to Imperial funds, and that provision for this additional expenditure should be made in the estimates of the Meteorological Department of the Government of India, with effect from the 1st April 1883. Unless His Hononr the Lieutenant-Governor has any objection to urge to this proposal, it will forthwith be carried into effect."

The extensions are now being effected as rapidly as circumstances will permit, and will be fully stated in next year's Administration Report.

Second Class Observatories.—These are seven in number, of which five are situated in Bengal and the remaining two in Assam. The following table gives the names of the Superintendents and observers at these observatories during the past year:—

STATIONS.	Superintendents.	Superintendent's allowance.	Observers.	Observer's allowance.	Assistant observers.	Assistant observer's allowance.
		Rs.		Rs.		Rs.
Sibsagar .	Dr. R. M. Meiklejohn[1] .	30	Babu Dandadhor Dutt Barua.*[2]	30	Babu Rateneswar Gogoi.	10
Dhubri . .	,, J. Mullane . .	30	Munshi Monirud-din Ahmed.*	30	Munshi Kadimuddin.[3]	10
					Munshi Kafait Ulla, Offg.	...
Bankipore	,, J. C. Shaw[4] . . ,, J. G. French[5] . .	30	Munshi Mohubbut Lal.	30	Munshi Muddun Mohun Lal.	10
Hazaribagh .	,, R. Cobb	30	Mahomed Ameer[6]	30	Nathu Lal[7] .	10
			Nathu Lal[8] .		Dwarkanath[9] .	...
Saugor Island	*Nil* . . .	...	Babu Heralal Seal.[10]	45	*Nil.*	...
			Mr. E. R. Swatman[11]		*Nil.*	...
			Babu Heralal Seal.[12]		*Nil.*	...
			Mr. A. J. Moth ..		*Nil.*	...
Cuttack . .	*Nil* . . .	...	Mr. J. C. Smith† .	32	Mr. H. W. Alley[14]	13
					Mr. S. Adams[15] .	
					Mr. H. W. Alley[16]	
Chittagong .	*Nil* . . .	...	,, E. Pereira[17] .	32	Mr. J. Dias .	13
			,, P. O. Pereira .	...		

[1] From 1st April 1882 to 15th September 1882, and from 28th October 1882 to 31st March 1883.

[2] Was in charge of the observatory from 16th September to 27th October 1882.

[3] On leave from 22nd July to 9th September 1882.

[4] 1st April to 1st December 1882.

[5] 2nd December 1882 to 31st March 1883.

[6] 1st April to 27th June 1882, when he was dismissed.

[7] 1st April to 27th June 1882.

[8] 28th June 1882 to 31st March 1883.

[9] Ditto ditto.

[10] 1st April to 18th October 1882.

[11] 19th October to 1st November 1882.

[12] 2nd November 1882 to 20th January 1883.

[13] 21st January to 31st March 1883.

[14] 1st April to 4th July 1882.

[15] 5th to 15th July 1882.

[16] 16th July 1882 to 31st March 1883.

[17] 1st April to 8th November 1882.

[18] 9th November 1882 to 31st March 1883.

* Received special allowance of Rs. 5 per month for good services.

† Received special allowance of Rs. 10 per month for good services.

Five of these observatories are furnished with self-registering anemographs. There were one or two breaks in the working of these instruments during the year, which are detailed in the following table:—

STATIONS.	Date of commencement of work.	Periods during which instrument was out of order during 1882-83.
Dhubri . . .	18th March 1882 . .	
Hazaribagh . . .	15th April 1880 . .	From 17 hours 30th April to 17 hours 31st May 1882. 17 hours 30th November to 10 hours 15th December 1882.
Chittagong . . .	20th June 1879 . .	1st April to 8th July 1882.
Saugor Island . .	9th February 1880 . .	9th January to 22nd February 1883.
Cuttack . .	11th April 1879 . .	

Three of these observatories, *viz.*, Bankipore, Hazaribagh, and Cuttack, were visited during the cold weather.

Hazaribagh was reported on unfavourably last year. This, which was formerly one of the most satisfactory of the Bengal observing stations, had fallen off solely in consequence of the indolence and carelessness of the observer. He was fortunately detected by the Superintendent in recording and sending to the Meteorological Office inaccurate and false statements, and was consequently dismissed from Government employment. The second observer was then appointed first observer, and appears to have done his work satisfactorily throughout the past year. The observatory was inspected on the 8th December 1882. No change has been made in the position of the shed during the past year, 1882-83, or of the instruments since my last visit in December 1881. The shed was clean and in good order. The anemograph tower required some slight repairs to make it water-tight. These have since been made.

The instruments were generally clean and in proper working order. The only instruments which were not perfectly satisfactory were the wet and grass minima thermometers. In both of these, the columns were badly broken. The instruments had, I was informed, given much trouble in this respect for some time previously. They were ordered to be replaced by new instruments. The anemograph was not working when I inspected the observatory, in consequence of the clock requiring cleaning. I found, however, that this instrument had been sadly neglected by the previous observer, and that it had not been in proper working condition for some months in consequence of two defects, both affecting the wind direction. The instrument had evidently not been cleaned or oiled for months. The gearing of the wind vane had consequently become rusted, to such an extent, as to make the vane immoveable under the action of any wind of ordinary strength. The chain connecting it with the recording part of the instrument had also lengthened slightly, and was badly adjusted, and too slack to work properly. These defects were repaired, and the observer taught how to oil it and to take it to pieces. Full instructions were also given to him to oil and clean it at regular intervals. The defective condition of the anemograph was, I found, mainly, if not entirely, due to the neglect and indolence of the previous observer. The observer and assistant observer read the instruments carefully and accurately. The present observer is intelligent, takes much interest in his work, and sends in his returns regularly. Hazaribagh thus promises to regain its former character as an observing station.

The Bankipore observatory was inspected on the 20th and 21st of December. No change has been made in the position of the instruments since Mr. Pedler's visit. The shed is in good order and has been protected by a fence. Strong ladders have been built, to give ready access to the anemometer and wind vane on the roof of the building. The barometer was examined, and a long series of comparisons made by the observer and myself, with two secondary standard barometers. The comparison seemed to indicate that the instrument has a variable index error, and that the amount of its error was, on the average of the observations, made during my visit, somewhat less than that assigned to it by the original comparison at Alipore. It was therefore replaced by one of the standard instruments, and ordered to be returned to Calcutta for a careful examination and re-determination of its index error. All the instruments were, with the exception of the barometer, in good order, and very clean. This observatory has improved very much since Mr. Pedler's visit, and is now in a satisfactory state.

The Cuttack observatory was inspected on the 11th of January. This observatory has been under the charge of Mr. Smith, Telegraph Master, for the past eleven years. I found the observatory in the same thoroughly satisfactory condition as on my last visit two years previously.

The Cuttack, Dhubri and Saugor Island observatories are the best of the second class observatories. I was unable to visit Dhubri during the year, but, judging from the accuracy of the observations and the neatness of the returns, I am confident that it has improved considerably during the past year. The observer has, moreover, on more than one occasion, sent valuable series of observations taken during storms. As he has been observer for many years, and continues to show increasing interest in his work, I have recommended him for the higher personal allowance of

Rs. 10. Sibsagar continues to work satisfactorily. Patna and Hazaribagh have both improved greatly, and may be considered as having regained their former character. The second class observatories are thus generally in a satisfactory condition, and the observers are performing their duties accurately and honestly.

Third class Observatories.—These were thirteen in number at the end of the year. Ten of them are in Bengal, one (Akyab) in Burmah, and two (Silchar and Tura) in Assam. The Tura observatory was established during the year at the suggestion of the Assam Government, and promises to give useful information for the eastern half of the Garo hill district.

Eleven of these are maintained solely by Government, one (Durbhanga) is supported by the Rajah of Durbhanga, and another (Demagiri) is a voluntary observatory established under rules sanctioned by the Government of India.

The following table gives the list of the third class observatories, with the Superintendents and observers of each, during the year 1882-83:—

Third Class Observatories.

STATIONS.	Superintendents.	Observers.	Observers' allowance.
			Rs.
Darjeeling, St. Paul's School.	R. Carter, Esq., Rector, St. Paul's School	Mr. W. Moore	25
Purneah	Dr. Picachy	Babu Russick Lal Bose [1] „ Rajanikanta Chackravarti [2] „ Russick Lal Bose [3]	15
Durbhanga	„ J. Ffrench-Mullen [4] „ J. C. Shaw [5] Babu Gopal Chundra Bose [6] Dr. W. A. Gilligan [7]	Jogin Chandra Banerji *	...
Gya	„ R. Macleod	„ Nowrangi Lal	15
Berhampur	„ S. M. Shircore	„ Mohendra Nath Roy †	15
Burdwan	„ J. O'Brein [8] „ H. B. Purves [9]	„ Mokhoda Prosad Chowdhury †	15
Jessore	„ D. W. D. Cummins	„ Poresh Nath Chowdhury	15
Dacca	*Nil.*	Mr. E. D. Shave [18]	25
		„ J. S. Davis [19]	15‡
Silchar	Dr. J. J. Monteith	Babu Romes Chundra Bhadra	15
Demagiri	*Nil.*	„ Nobin Chundra Ghose [10] „ Bhagarath Barmah [11] „ Surjya Kumar Ghose [12]	*Nil.*
False Point	*Nil*	Mr. E. Workman [13]	25
Akyab	*Nil*	„ J. M. Bennett [14]	25
		„ P. G. Pote [15]	15§
		„ H. J. Smythe [16]	15
		„ R. J. Keys [17]	15
Tura	Civil Medical Officer	......	...

[1] 1st April to 16th July 1882.
[2] 17th July to 31st October 1882.
[3] 1st November 1882 to 31st March 1883.
[4] 1st April to 13th December 1882.
[5] 14th December 1882 to 6th March 1883.
[6] 7th March to 16th March 1883.
[7] 17th March to 31st March 1883.
[8] 1st April to 24th October 1882.
[9] 25th October 1882 to 31st March 1883.
[10] 1st April to 9th December 1882.
[11] 10th December 1882 to 11th January 1883.
[12] 12th January to 31st March 1883.
[13] 7th August 1882 to 31st March 1883.
[14] 1st to 3rd April 1882.
[15] 4th to 18th April 1882, and 4th June to 8th September 1882.
[16] 9th September 1882 to 15th February 1883, and 22nd February to 31st March 1883.
[17] 19th May to 3rd June 1882, and 16th February to 21st February 1883.
[18] 1st April to 28th December 1882.
[19] 28th December 1882 to 31st March 1883.

* Received special allowance of Rs. 5 per month.
† Ditto ditto „ 10 „
‡ From 28th December 1882.
§ „ 9th September 1882.

I was able to visit the whole of the third class observatories during the college cold-weather vacations, with the exception of Jessore, Silchar, and Akyab. No change was made during the past year in the character of the observations or the condition of the observatories. My opinion of them is unchanged. Some of them are quite equal to the second class observatories as regards the accuracy and value of their observations. In others, occasional carelessness and neglect of the instructions laid down in the *Vade Mecum*, diminish very considerably the value of the observations, and introduce an element of doubt into the results of their work.

The following accounts of the observatories which were visited during the cold weather are taken from my inspection reports:—

"I visited the Darjeeling observatory on the 16th and 17th of November. The shed was in capital condition; the instruments clean and in good order, and properly placed. The Casella's anemograph had been properly placed in position before my visit in November. The shed in which it is placed is on a fine open site on the top of a hill above St. Paul's School. When I was there, the air was perfectly calm, so that I had no opportunity of seeing the instrument working under ordinary conditions. I examined it carefully, and made several changes. It has been working since, and the observer, Mr. Moore, has spent much time, labour, and ingenuity in endeavouring to make it work successfully, but the results are not altogether satisfactory. The traces received lately are sufficiently distinct to enable them to be used for the determination of the elements of wind observation. So far as I can judge, the instrument is not a good one, and I should prefer to see it replaced by a Beckley's anemograph, which gives a continuous record. Experience appears to show that the Beckley's is easier to work and less liable to derangement.

"The Purneah observatory was inspected on the 23rd, 24th, and 25th of December 1882. The shed is on the same site as it occupied on my last visit two years ago. I found that the foundations of a house for the jailor had been laid within a few feet of the observatory, and the building itself would be shortly erected. It was therefore necessary to give orders for the early removal of the observatory. A suitable site was selected, where the conditions of exposure are almost identical with those of the present observatory. The shed itself was in fair order. No repairs had been made for some time in view of its removal to another site. The thermometers were all clean and in good order. The barometer was in the same room as two years ago. As the light in it is bad, I removed the barometer to an adjacent room at the same level, and where it is in good light. The barometer was carefully compared at the dâk bungalow by myself, and its index error was ascertained to be unaltered. The wind vane and anemometer are well placed. They were slightly stiff in consequence of not being oiled frequently enough. The anemometer was carefully oiled and cleaned, and the observer instructed how to keep it in proper condition. He read the anemometer somewhat imperfectly. This was partly due to his having overlooked the instructions in the *Vade Mecum*. He learnt quickly, and I hope the anemometer observations at this station will in future be exact. The observer is intelligent and punctual in his work, in which he appears to take much interest. The observatory, on the whole, is in a satisfactory condition.

"Durbhanga was inspected on the 20th and 21st of December 1882. I arrived at the observatory at 4-7 P.M. by the dispensary clock, and found the observer there. On enquiring about the 4 P.M. observations, I was shown the following entries for that day:—

	10h.	16h.	18h.
Barometer	30·130	29·030	
Attached thermometer	66·5	71	
Dry bulb	67	74	
Wet bulb	62	65	
Dry max.	...	...	74·8
,, min.	54·5	...	
Wet ,,	53·5	...	
Grass ,,	41·5	...	
Sun max.	...	...	118
Anemometer	248·4	265·3	
Wind direction	22	22	

"The observer was then asked to read the barometer, and stated that it was 29·980. I read it myself and found it to be 29·968. The reading entered in the form B, even if corrected to 30·030, was thus erroneous. The observer then endeavoured to excuse himself by asserting that he had been at the Magistrate's court and that an assistant had taken the readings. As it was unnecessary for me to ascertain more than I did (*viz.*, that the observations at Durbhanga on this day, and probably, as indicated by the returns, for some time previous, had been taken in an exceedingly careless and irregular manner, and that little or no attention has been paid to the various instructions and orders issued from time to time for his guidance), I made no attempt to verify his statements. No excuse whatever can be admitted in extenuation of the offence of entering the observations as having been taken at the exact times noted, when, in reality, they have been knowingly taken at some other entirely different hour. In addition to the evident mistakes in the 4 P.M. readings, observations purporting to be taken at 6 P.M. had been taken at or before 4 P.M.

"The condition of the observatory indicated great carelessness on the part of the observer. The thermometers were in very fair order, except that they were generally somewhat dirty. The minimum wet bulb and ordinary wet bulb were covered with a thickish encrustation.

"The wind vane worked slowly and heavily. This was accounted for by the fact that it had not been oiled for some months. The anemometer was excessively dirty, and was covered with dust inside and outside. No oil had been given to it for months. In consequence of the dust and want of oil, the instrument moved with much friction. It is evident that the anemometer observations have been of litte value for some time past. The Durbanga observer was informed that carelessness in observation, or laxity with regard to hours of observations, once clearly detected in an observer, throws a doubt for a long time over future observations, and that it would therefore take long for him to thoroughly re-establish a character for accurate work; and was informed that he would probably lose his personal allowance of Rs. 5 per mensem. I referred the matter to Mr. Blanford, explaining to him the peculiar condition of the observatory and the promise of the observer to do good honest work in future. He requested me to fine the observer ten rupees as a mark of his serious displeasure, and to warn him that the detection of any similar faults in the future will be certainly followed by the withdrawal of the personal allowance.

"Gya was inspected on the 11th and 12th of December 1882. No change has been made in the position of the instruments since my last visit, and the shed was in perfect order. The barometer was carefully examined, as the barometric observations had been unsatisfactory for some time. The readings for some months, as indicated by the observations at the neighbouring stations, had been much too high. A long and careful comparison, made by myself at the dâk bungalow, proved that no change had taken place in the index error of the instrument since its issue to Gya. I however found, when the observer was asked to take a reading of the instrument, that he immersed the fiducial point well into the mercury in the cistern, instead of setting it so as to touch exactly the mercurial surface. This error at once explained the high readings at Gya. I spent several hours in endeavouring to teach him to adjust the level of the mercury to the fiducial point, and in reading the instrument with fair results. The observer attributes his error in this respect, chiefly to failing sight. This was, however, not confirmed by the Civil Surgeon. It is therefore more probably due to carelessness, and he was warned on this point to be much more careful in future. The instruments were all in good order. The observer, I found, read the anemometer very imperfectly, and it was necessary to spend some time in training him to read it correctly. The condition of the Gya observatory, in consequence of these imperfections on the part of the observer, has been for some time far from satisfactory.

"Berhampur was inspected on the 28th of December 1882. The instruments have been housed in a new shed since my last visit. The shed is very neatly built and is in capital condition; the instruments were clean and in thoroughly good working order. This observatory is in almost every respect one of the best kept in Bengal, and reflects great credit on the observer, who is, I have every reason to believe, as accurate in his observations as he is interested in the neat appearance of his observatory.

"Burdwan was inspected on the 29th December. I found both the shed and instruments in perfect order. The observatory is in thoroughly satisfactory condition and continues to maintain its high character."

Dacca was inspected at the end of November. The shed is situated in the compound of the Telegraph Office in a fairly exposed position. It was in good condition, and the instruments clean and in excellent order. This observatory was last visited by Mr. Pedler in December 1878, when it was favourably reported upon.

The observatory at False Point has been located at the Jumboo Telegraph Office, for the past four years. This office was closed on the 25th of April 1882. No previous intimation was given to me of this change. The observations at False Point were then suddenly broken off, and I was unable for some time to make any arrangement for the re-establishment of the observatory. In August, the light-house was connected by telephone with Cuttack. This enabled me to re-establish the observatory under its former conditions before its removal to Jumboo, and at the same time to preserve the advantage of telegraphic communication with Calcutta. It was not considered advisable to erect a shed until the cold weather. Mr. Workman, light-house keeper, took the greatest interest in its re-establishment at the light-house. He procured the instruments from Jumboo and placed the barometer in the lower room of the light-house and the thermometers temporarily in a verandah facing the north, and forwarded daily telegrams of the height of the barometer, wind direction and force, rainfall, &c., from the 7th of August. I visited False Point in January, and in conjunction with Mr. Workman selected a suitable site for the new shed and for a pillar, on which to erect the wind vane and anemometer. This station is a very important one in connection with the Storm Signal Service, and it is to be regretted that the telephonic mode of communication usually fails during stormy weather. Mr. Workman informs me that he has frequently spent a couple of hours, shouting himself hoarse, in endeavouring to communicate with Cuttack during windy and stormy weather. If the Telegraph Department could arrange to improve the communications between the light-house and Hookeytollah or Cuttack, the False Point observatory would be under its present conditions one of the most satisfactory and important of my observatories.

Of the third class observatories, Berhampore, Burdwan, Dacca, Darjeeling and False Point take first rank for the accuracy and value of their observations. Purneah is now a fairly satisfactory observatory. Silchar and Jessore I was unable to visit during the past year, and can only judge of them by their returns. So far as they indicate, these two observatories have improved during the year, more especially Jessore, the returns from which have been neatly prepared and sent in with commendable regularity.

Durbhanga and Gya have been the most unsatisfactory of my stations during the past year. At Durbhanga the observer had allowed himself to fall into very careless habits and methods of observations, and I hope after the leniency shown to him he will use every effort during the present year to submit accurate observations and keep his instruments in such a condition as to be fit for inspection at any moment.

Akyab has been also a somewhat unsatisfactory station during the past year. I recorded my opinion in the Administration Report for 1881-82 that it was not quite satisfactory, as frequent mistakes were made in the transmission of weather telegrams. It is an important station, from its position on the Aracan coast. I regret to have again to record that numerous mistakes have been made in the preparation of the weather telegrams, due either to haste or carelessness. In the month of August last ten of the thirty telegrams despatched were erroneous in one or more particulars. The ordinary returns also frequently contain errors, and it is only too probable that the carelessness, shown in the preparation of the telegrams and ordinary returns, extends to the work of observation itself. It contrasts most unfavourably in these respects with Cuttack, Dacca, and Saugor Island, at all of which Telegraph Masters are observers.

Rainfall-recording stations.—Regular rainfall returns have been received during the past year from 164 sub-divisional stations. During the past year two stations—Segowlie and Baripore—have ceased to send in returns, as they are no longer sub-divisions; on the other hand, rainfall returns were received during a part of the year from three new stations—Netrokona, Banki, and Hookeytollah (False Point). The number of stations submitting rainfall returns at the end of the official year was 162.

These returns were submitted in the great majority of cases punctually, and the monthly return of rainfall throughout the provinces for each month of the past year, prepared from these returns, was published in the Gazette on the third or fourth week of the ensuing month.

Instruments.—The two following tables show the number and kind of instruments that have been broken or lost or rendered unserviceable at the Bengal observatories during the year 1882-83, and of the instruments supplied to the observatories to replace broken, deteriorated or untrustworthy instruments.

Return of Instruments broken or otherwise injured at the Observatories in Bengal and Assam, 1882-83.

STATIONS.	Barometer.	HYGROMETER.		Dry Maximum.	MINIMUM THERMOMETER.		RADIATION THERMOMETER.		Anemometer.	Wind vane.	Rain-gauge.	Measure glass.	Lens.	Clock.	Sand glass.
		Dry.	Wet.		Dry.	Wet.	Solar.	Grass.							
Patna	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(*c*) 1
Cuttack	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Chittagong	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Saugor Island	...	...	...	...	...	...	...	...	(*a*) 1	...	...	...	...	...	...
Hazaribagh	...	...	...	...	...	(*a*^{1}) 1	...	(*a*^{1}) 1	...	...	...	...	...	...	...
Purneah	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Burdwan	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Berhampore	...	...	...	...	...	...	(*b*) 1	(*a*) 1	...	...	...	...	...	...	...
St. Paul's School, Darjeeling	...	...	...	...	...	...	...	(*d*) 1	...	...	...	...	...	...	...
Jessore	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
False Point	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dacca	...	...	...	...	(*a*) 1	...	...	...	(*a*) 1	...	...	...	...	...	...
Durbhanga	...	...	...	...	...	...	...	...	(*a*) 1	...	...	...	...	...	...
Gya	...	...	...	...	...	...	...	(*d*) 1	...	...	...	...	...	...	...
Akyab	...	...	...	...	(*a*) 1	(*a*) 1	(*d*) 1	...	...	...	...	...	...	...	...
Gopalpore	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sibsagar	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dhubri	...	...	...	...	...	...	...	(*e*) 1	...	...	...	...	...	...	...
Cachar	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Tura	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Demagiri	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(*a*) Out of order. (*a*^{1}) Condemned.
(*b*) Cracked.
(*c*) Broken in transit.
(*d*) Broken.
(*e*) Stolen.

Comparatively few instruments were broken during the year. At Gya, the terrestrial radiation thermometer was broken to pieces by a stone thrown from a road outside the compound. An exposed grass radiation thermometer disappeared at Dhubri under circumstances which indicated that it had been probably stolen by coolies travelling up to the Assam tea gardens, a depôt for whom is within a few yards from the observatory. The instrument which was broken at Akyab is reported to have fallen by accident to the ground when it was being examined by the observer.

During my tour of inspection I condemned several instruments, more especially alcohol minimum thermometers, which frequently deteriorate rapidly in India, and ordered them to be replaced by new instruments. This, for example, explains the issue of thermometers to Hazaribagh, Berhampore, Patna, and False Point. On the whole, the instruments appear to have been carefully looked after during the past year.

Central Office.—The office establishment consisted of the following clerks on the 31st of March 1883:—

Names.	Rank.	Salary. Rs.
Babu Chandi Churn Chatterjee	Head Clerk	80
„ Poorna Chunder Mookerjee	Second do.	43
„ Jogesher Roy	Third do.	25
„ Kamini Mohun Bosu	Tabulator	32
„ Banikant Roy Chowdhury	Do.	22
„ Bireshar Mookerjee	Do.	20

Babu Chandi Churn Chatterjee is active and intelligent, and is a very efficient Head clerk. He has controlled and managed the office very successfully during the past year, and thus enabled me to propose, without hesitation, extensions for the improvement of the Department, which I would otherwise have found it difficult to carry out.

No change was made during the year in the ordinary routine of the office. The following returns have been prepared during the year for publication in the *Calcutta Gazette*:—

1st.—Monthly summaries of the meteorological observations taken at twenty observatories in Bengal and Assam.

2nd.—Monthly statements of rainfall at 162 sub-divisional and other stations in Bengal, and in the same form as last year.

3rd.—A table showing the monthly and total rainfall for the year 1882 at 162 stations in Bengal.

4th.—A table giving the average monthly and annual rainfall at 156 stations in Bengal, based on the rainfall returns up to 31st December 1882.

5th.—Comparison rainfall table for the year 1882, showing the monthly and total variation of the rainfall of 1882 at 162 stations, from the mean rainfall given in the preceding table.

My time has been more fully occupied than usual during the past year, and I have thus had less leisure to devote to meteorological investigation apart from the ordinary routine of my work.

I have nearly finished an analysis of the storm of October 1882, which possessed several features of interest. It occurred during the October transition period, when there is a tendency for any vortex that is formed in the Bay to develope into an intense and severe cyclone. Although it formed at the most dangerous period, during pre-existing conditions, which are known to be favourable to cyclonic formation of the Bay, some condition or action was absent, or very feebly developed, which prevented the storm acquiring great intensity. It was due to, and accompanied, a large shallow depression with moderately high gradients on the outskirts of the storm area. The aqueous vapour condensation, judging from the appearance of the sky during the storm, seems also to have taken place at a comparatively low level. It was economically chiefly remarkable as giving the heaviest and most general burst of rainfall to Bengal during the south-west monsoon of 1882.

In several respects, it resembled the storm of September 1878, the account of which I drew up last year, and which was published during the present year as the first paper in the second volume of the Meteorological Memoirs.

I also took up for discussion all the storms which occurred in the Bay of Bengal during the period 1875 to 1880, of which there are records in the office, with a view to determine the relations between storm occurrence in the Bay and the general character of the monsoon, and also, if possible, the distribution of south-west monsoon storms in the Bay with respect to time and place.

This I find will take longer to work out than I originally expected, but I hope to finish it in the course of the present year.

Storm signals.—In my last year's report I stated that, I had submitted to the Government of Bengal, proposals for the extension of the system of storm signals for warning the Port of Calcutta of the approach of cyclones. The original object of this part of the work of the Bengal Reporter was to forewarn the port of the approach of severe cyclones, such for example as those of 1864 and 1867, in order that captains of vessels, &c., might prepare for the advent of the attendant destructive storm-wave. Recent experience has, however, shown that, although severe cyclones accompanied by storm-waves are of comparatively rare occurrence at the head of the Bay, cyclonic storms of limited extent and intensity are, on the other hand, frequently formed during the rains, and are a source of danger to shipping entering or leaving the mouth of the river. The storm signals hitherto employed were only intended to give warning of the formation and approach of storms of the first kind; hence it became necessary, if the Department was to give warning of the advance of storms dangerous to shipping in or near the mouth of the river, as well as to shipping in the port, to extend or modify the system of signals. This I did with the assistance of Mr. Elson, Master Pilot, in such a way as not only to differentiate between the intense cyclones of the transition periods, and the feebler cyclonic storms of the rains, but also to indicate roughly what part of the Bengal coast they are approaching and likely to cross. The Government of Bengal sanctioned the proposed signals on the 5th of August 1882.

The adoption of the new system of storm signals was duly notified in the *Calcutta Gazette* on the 9th August 1882. They were brought into operation almost immediately afterwards, and as soon as the new signals could be prepared and despatched to the signal stations. Signals, giving warning of the existence of any dangerous storm near the head of the Bay, will in future be hoisted for the information of the pilots, captains of vessels, &c., at Saugor Island, Mud Point and Diamond Harbour. Signals will in future be hoisted in Calcutta only before the approach of a severe cyclone with a storm-wave of sufficient magnitude to be probably dangerous and destructive to shipping in the port. The storm signals in the port of Calcutta will be hoisted in the following positions :—

1st.—On the Port Commissioners' office.

2nd.—On a flagstaff at Seebpore, nearly opposite to the Fort.

3rd.—On the yardarm of a flagstaff near the Government Dockyard, Kidderpore.

No severe cyclone occurred in the Bay during the year 1882. Six cyclonic vortices formed near the head of the Bay, and advanced across the Bengal or Orissa coast into the interior. These were—

1st.—Storm of June 8th to 17th, which ushered in the south-west monsoon. The centre crossed the Orissa coast on the 10th.

2nd.—Storm of 16th to 23rd of July. This crossed the Bengal coast near the mouth of the Hooghly on the 19th.

3rd.—Storm of 5th to the 14th of September, which crossed the Orissa coast between False Point and Balasore on the 7th.

4th.—Storm of the 14th to 19th of September, which advanced across the Orissa coast on the 16th.

5th.—Storm of the 26th of September to the 3rd of October. This crossed the Orissa coast on the 28th.

6th.—Storm of the 12th to 17th of October, which formed near the coast of the Northern Circars, crossed the Ganjam and Orissa coast, probably between Gopalpore and Pooree early on the morning of the 15th, and then proceeded northwards into Northern Bengal.

Four of these storms, *viz.*, 2, 4, and 5, although accompanied with moderately strong winds and a rough sea, did not appear to be of sufficient intensity to justify the hoisting of the storm signals. Warning signals were hoisted for storms Nos. 3 and 6. On the approach of the 3rd storm bad weather signal No. 7 was hoisted on the 7th September at 12-30 P.M., intimating that a small cyclonic storm was advancing to the east of the Hooghly. This was changed on the receipt of further information to storm signal No. 8 at 7-30 A.M. of the 8th. The signals were taken down at 2 P.M. of the 9th. During the sixth storm, signal No. 5, intimating the existence of a storm which would cross the west coast south of False Point was hoisted at 2 P.M. of the 14th; the signals were taken down at noon of the 16th.

Daily Weather Reports.—These have been published during the past year in the same form as during the previous. They were supplied to 27 subscribers and to 23 Government officials at the commencement of the official year, and to 29 subscribers and 30 Government officials at the end of the year. The receipts during the year from subscriptions have covered the cost of printing and distributing the reports. There was a small balance of Rs. 105 at the end of the year, which was kept in hand in order to meet any charges for repairs to the lithographic presses.

The report has hitherto been published on an awkward, large-sized sheet of inferior paper which has detracted considerably from its appearance. By reducing the size of the form considerably, I have been able to obtain paper of much better quality for the report and chart. Through the courtesy of the Superintendent of the Lithographic Department of the G. T. Survey, I was supplied with a neat chart and form from which to prepare the daily reports. The report will thus in future (from May 15th) be issued in a neater and more compact form. Although the number of subscribers has not increased much, I believe the report and chart are found to be of use. I should be glad to see the number of subscribers increased, so that the subscription could be reduced from Rs. 2 per mensem to Rs. 12 per annum.

Marine Meteorology.—A fair amount of work has been done in this during the past year. The Government of India sanctioned additions to the previous office establishment with effect from the 1st of April. The work proposed to be done under this head consisted of two parts. The first is the discussion of the observations taken on board vessels navigating the Indian seas, collected by the Board of Trade in England some years ago, and made over to the Indian Meteorological Office; and the preparation of charts embodying the information given by these observations of the pressure, winds, currents, &c., in the Bay of Bengal and Arabian sea. During the early part of the year the barometric observations were taken up with a view to determine the amount and character of the diurnal oscillation in the Bay. The curves have been worked out for all the months, excepting December, and are ready for publication whenever it may be considered desirable to do so. Shortly after Mr. Dallas, Scientific Assistant, came down to Calcutta from Simla, he took over the work of tabulating and charting the data. Four additional clerks were engaged. The barometric and wind data for January were gone through and tabulated, and the results charted. The second branch of the work of the Department is the collection of current meteorological data of the Bay of Bengal from every possible available source. Forms were prepared in accordance with suggestions made by the Port Officer. A supply of these is included in the papers handed by all pilots to the captains of vessels entering the river on taking piloting charge. A large number of captains have complied with the request of the Department to furnish extracts of meteorological data in these logs for the Bay of Bengal and Indian sea. Three hundred and forty-five sets of returns were filled up and sent in to this office. Many of these are of great value, and show that accurate meteorological observations are taken on board a fair proportion of the ships navigating the Bay of Bengal. The information contained in these has been extracted and entered in books for permanent record in such a way that the information for any one day is collected together. The information they give is also being added to the daily weather charts for India, prepared in the India Meteorological Office. I have not had time to go through this information as fully as I should have wished, but the extracts I have considered indicate clearly the general truth of what I had previously surmised, *viz.*, that the weather in the whole extent of the Bay, excluding the Andaman sea, is fairly indicated by the observations taken at the coast stations, and that the progress of every important storm may be traced and followed with more or less exactness almost from its origin, from the shore observations.

In addition to this information, observations with verified instruments have been taken at 10 A.M. and 4 P.M. on board the light-vessels near the mouth of the Hooghly. The following gives the dates from which returns have been received during the past year:—

Meteor	from	May	1882.
Star	„	June	„
Comet	„	August	„
Mermaid	„	November	„

The observations taken on board these vessels are, I have every reason to believe, after careful examination, to be accurate and trustworthy. They are very valuable as extending our knowledge of the meteorology of this part of India to a distance of 40 miles beyond the coast seawards.

FINANCE.

The following statement gives the total cost to the State of the Bengal Meteorological Department during the year 1882-83:—

	R	a.	p.	R	a.	p.
Meteorological Reporter	3,600	0	0			
Office establishment	2,764	1	10			
Office rent	900	0	0			
Observers: Telegraph Masters[1]	2,325	0	0			
Observers: Native observers	3,480	0	0			
Messengers' allowances	78	0	0			
Superintendents' allowances	1,440	0	0			
				14,587	1	10
CENTRAL OFFICE.						
Contingent and office furniture	571	6	9			
Postage	507	9	0			
Telegraphic messages	9,646	4	0			
Travelling allowances	926	8	0			
				11,651	11	9
OBSERVATORIES.						
Building and repairs	473	6	9			
Contingent	83	9	0			
				556	15	9
GRAND TOTAL				26,795	13	4

The total is Rs. 2,155 in excess of last year. This is, however, due almost entirely to increase in the nominal charges for telegraphic messages and postage. The weather telegrams for the use of the Calcutta Storm Signal Service were despatched throughout the year as "urgent." This caused the large increment under that head. The increased correspondence and circulation of the Bay of Bengal daily weather reports to Government officials explains the increment under the head "Postage." Building and repairs were well within the budget allowance, in consequence mainly of the large expenditure under this head last year.

The statement does not include the cost of instruments supplied to the observatories by the Indian Meteorological Department, nor does it include the cost of stationery supplied to the central office, or of printing the various forms required by the office, nor of printing the meteorological returns published in the Gazette or otherwise.

JOHN ELIOT, M.A., F.M.S.,
Meteorological Reporter to the
Government of Bengal.

METEOROLOGICAL OFFICE, BENGAL;
The 30th May 1883.

---

[1] Paid through the Telegraph Department.

APPENDIX B.

Administration Report of the Meteorological Reporter to Government, N.-W Provinces and Oudh, for the year 1882-83.

No changes of any importance have occurred in the working of the Department during the year. No new observatories have been opened, nor have any of the old ones been closed; and the only changes that have taken place in the status of the existing observatories have been the admission of the voluntary one at Pithoragarh to the list of Government third class observatories, from the 1st May 1882, and the complete equipment during the year of the Jeypore observatory as one of the first class.

At the beginning of the current year, the observatories reporting to the Allahabad office were twenty in number—fifteen in the North-Western Provinces and Oudh, three in Rajputana, and two in the Central India States. In the following table these observatories are classified according to the kind of observations they furnish and also according to the way in which the observers are paid :—

How maintained.	Class.		
	I.	II.	III.
By Meteorological Department	Allahabad (in abeyance).	Allahabad . . . . Lucknow . . . . Agra . . . . . Roorkee	Chakráta. Ranikhet. Pithoragarh. Bareilly. Gorakhpur. Benares. Sutna. Jhansi. Ajmere. Sambhar.
By other Government Departments	......	......	Dehra.[1] Gházipur.[2]
Voluntarily or by Independent States, &c. . . .	Jeypore[3] . . .	......	Meerut.[4] Nowgong.[5] Pauri.[5]

---

[1] Maintained by Survey Department.
[2] Ditto Opium Agency.
[3] Ditto State Durbar.
[4] Maintained by Municipality.
[5] Observers unpaid.

A list of the observers and Superintendents who have held charge of these observatories during the year, and of the periods during which they acted, will be found in Appendix B. III.

OBSERVATORIES OF THE FIRST CLASS.

Allahabad.—The question of the construction of a first class observatory for these Provinces has advanced during the year, but only very slightly. It has now been finally decided to build the observatory at Allahabad instead of at Cawnpore, Lucknow or elsewhere; and plans for a building to accommodate the observatory and the meteorological office are now being prepared in the Executive Engineer's office at Allahabad. But it is possible that the question of a site for the observatory in Allahabad may be re-opened; because, at the site already determined upon, in the Muir College compound, no building except one designed by the architect of the college can be erected without the possibility of injuring the college from an architectural point of view. Should a new position be determined upon, the observations of temperature and humidity which have been made at the college since the middle of April 1882, and are still being carried on, will be useless.

These observations, printed in Appendices V and VI, indicate that the mean temperature at the college is three quarters of a degree higher than at the old observatory; that the differences are greatest in the cold weather months, when they amount to 1·5°; and that the minimum temperatures differ but slightly, while the maxima differ considerably, the daily range being consequently a degree larger at the college than at the old observatory, on the average of the year, and three degrees larger in December. The observations also indicate that the air is very considerably drier at the new than at the old site, at all times of the day, but especially at 10 A.M.

The differences in the meteorological constants of the two places, thus brought to light, are so large, that it has been thought necessary to extend the comparison for another year, especially as some of the series of observations—those relating to radiation—are incomplete, the railing which surrounds the observatory shed at the college and protects the exposed instruments not having been put up until near the end of the year. These differences are almost certainly due to the peculiar position of the old observatory, in a low-lying, well-wooded garden, where, in winter, when the sun does not rise high in the heavens, the ground near the thermometer shed is shaded during the greater part of the day. It is highly probable that differences equally great will be found between the old observatory and any open place in the vicinity; and therefore if an entirely new site be ultimately fixed upon for the observatory, a new series of comparative readings, extending over one or two years, must be made.

At present, as in former years, Allahabad continues to work as a second class observatory, additional observations being made however at 4 A.M. and 10 P.M., and various special observations being carried on as well. The observer, Babu Kedar Nath Chatterji, continues to do excellent work, and has therefore been allowed to retain for another year a special allowance of Rs. 10 per mensem in addition to his pay.

Jeypore.—Under the energetic superintendence of Dr. Hendley, and with the able assistance of Major Jacob, R.E., a handsome building, in Indian style, was erected for the accommodation of the Van Rysselberghe meteorograph with its various accessories, and the instrument was installed and brought into action early in the year. A short account of the administration of the Jeypore Meteorological Department by Dr. Hendley is given in the Appendix II. The observatory was inspected by the Meterological Reporter for India at the commencement of the cold weather, and I visited it in December. The ordinary instruments at the time of my visit were all in perfect order, and the meteorograph was working beautifully, except that the wind direction apparatus was slightly deranged.

The monthly registers of eye observations of the various instruments, made on the system pursued at Allahabad, have been regularly received, and on examination prove, as far as may be judged from internal evidence, that the observations were carefully taken. These already constituted a valuable series of meteorological data for a part of the country previously unrepresented, and the records of the meteorograph will be still more valuable.

OBSERVATORIES OF THE SECOND CLASS.

Lucknow.—The work of this observatory has been carefully performed during the year by the observer, Babu Chotay Lal, who has sent in the monthly registers neatly written, generally correct as regards arithmetical work, and punctually prepared. The observatory was inspected in May, when all the usual instruments were found clean and in excellent condition. The Beckley anemograph had been removed to the new and better position, mentioned in last year's report, but though it now works much better than formerly, the velocities indicated by it are still too low to be perfectly trustworthy, doubtless because there are still some buildings and trees in the neighbourhood higher than the instrument.

Babu Chotay Lal has also been allowed to retain for another year his personal allowance of Rs. 10 per mensem.

Agra.—This station was inspected in December. The instruments were found to be clean and generally in good order at the time of my visit, the exceptions being the raingauge and the solar radiation thermometer. The latter had a small quantity of mercury, equal to about 0·30 of the scale condensed at the top of the tube. The raingauge funnel was not quite level, probably owing to some unrecorded change in the receiving bottle, for the tube of the funnel, which was rather long, touched the bottom of the receiver before the funnel came down into its proper position. This was remedied by cutting an inch off the end of the funnel tube. Since my visit, the raingauge has been surrounded for protection by a stout wooden paling, and all the buildings, &c., are now in good order.

The observer, Mir Altaf Ali, though he generally takes good care of the instruments and reads them correctly, has during the year made frequent mistakes in the reduction of the observations, and his registers and returns have often been written in a careless and slovenly manner, though latterly they are much improved. His personal allowance has therefore been reduced this year from Rs. 10 to Rs. 5 per month.

Roorkee.—This observatory was not inspected during the year. The returns have been punctually received and have apparently been prepared with care. From the evidence of the registers, the observations seem to have been made punctually and accurately, and this is the opinion of the Local Superintendent, Dr. Murray Thomson, regarding their character. In reducing the registers and striking the monthly means, however, the observer, Babu Chiranji Lal, still makes mistakes, and therefore, while in recognition of the general improvement in his work he has been recommended for a special allowance this year, it is an allowance of only Rs. 5 per month.

OBSERVATORIES OF THE THIRD CLASS.

Chakrata.—This station was not inspected. The returns have been punctually received and the observations appear generally to have been carefully made. The observer, Munshi Salig Ram, retains this year the personal allowance of Rs. 5 per month previously granted to him.

Ranikhet.—The observatory at Ranikhet was inspected at the beginning of June. The buildings were all in good order except the barometer room in the observer's house, the earthern floor of which was very damp. A new floor of boards has since been laid down. The instuments were clean and in good order. The anemometer, which is now mounted on a pillar about 4 feet high above one of the gables of the observer's house, seems to record considerably less movement than it did in its former position on the stump of a large pine tree. The observer, Pandit Jewa Nand, who has managed the observatory very well for several years without any Local Superintendent, gets this year an allowance of Rs. 10 per mensem in addition to his pay.

Pithoragarh.—This station, which has not yet been inspected, was brought on the list of Government observatories on the 1st May 1882, having been opened a year previously as a voluntary one. The Superintendent, the Rev. Dr. Gray, has looked carefully after the work of the observer, and the observations have consequently been very carefully taken; but Dr. Gray has recently removed his head-quarters to Almora, and will in future visit Pithoragarh only at intervals of two or three months. It remains to be seen whether the observer will be able to maintain the high character of the observations when left a good deal to himself. Hitherto there have been no signs of deterioration.

Bareilly.—This observatory was inspected in May. The observatory shed and surrounding railing required slight repairs, which have since been executed. The clock was five minutes fast by railway time, though the local time should be about six minutes slow. The instruments were generally in good order, but some of them were very dirty, the barometer being covered with splashes of whitewash, and the wet bulb thermometers thickly coated with a lime deposit, which had been rendered insoluble by sulphuric acid. The solar thermometer had a quantity of mercury equal to nearly 2° of the scale collected at the top of the tube, and never allowed for or even observed. For his general carelessness the observer, Munshi Jwala Prasad, was severely reprimanded. It is hoped that he will do better in future.

Gorakhpur.—This observatory was not inspected during the year. The returns have been regularly received, but the present observer, Hospital Assistant Nizam-ud-din, who has not been long at the work, makes mistakes sometimes in reading the instuments, and does not seem to understand properly the use of decimals. On the whole, however, his work has been fairly good, but he has not been recommended for any of the special allowances.

Benares, Sutna.—Neither of these stations was inspected during the year. The returns have been regularly received and the observations of each appear to maintain their previous character for accuracy. The observers, Devakinandan Pathak and Har Nath, retain the special allowances of Rs. 5 per month previously granted them.

Jhansi.—The observatory at Jhansi was inspected in December. The thermometer shed was in good order, but the dispensary building (not belonging to the Meteorological Department) in which the barometer was hung, was in a condition which might be described as dangerous. Owing to the widening of a crack in the wall against which the barometer was hung, this instrument had gone a little out of the perpendicular, but was otherwise in good order. It has now been removed to another wall, which seems sounder than that on which it formerly hung. The thermometers were generally in good condition, but a quantity of mercury equal to 2° of the scale had collected at the top of the solar radiation instrument. The enclosure round the raingauge and radiation instruments required renewal, and this has since been done. The anemometer and wind vane on the roof of the dispensary had been overtopped by young trees since the time of my previous visit, and as it was impossible to raise a pillar on the roof on which to mount them at a greater elevation, they were taken down and will now be put up on a special scaffolding erected in an open spot at some distance. The observer, Hospital Assistant Kalka Das, has been many years in the Department, and has done fairly good work, but owing to his inattention to small but important details fully described in the book of instructions, he has not yet been recommended for any special allowance.

Ajmere, Sambhar.—These stations have not been inspected this year. The returns have been punctually received and have generally been correct, though the Sambhar observer still makes occasional mistakes. The work of the Ajmere observer, Munshi Ram Parshad, who has been many years in the Department, has been very well done during the year, and he has been recommended for a special allowance of Rs. 5 per month.

Other Observatories.—Of the third class observatories, not maintained by the Meteorologicals Department, none were inspected during the year except Nowgong. At this station the instruments were generally found in good order, almost the only fault to be found with the practice of the observer being the common and constantly recurring one of using well water for the wet bulb thermometers. The barometer had been removed into an inner room, where the light was defective, when the room in which it was formerly kept was under repair, and had not been put back again, but it has now been restored to its original position. On comparison with two similar instruments taken with me the barometer was found to read ·008″ lower than when its index error was determined in Calcutta.

The observations made at all the voluntary stations have been regularly received, and abstracts of the results published along with those of the Government observatories.

SUPPLY OF INSTRUMENTS.

The instruments issued to the observatories have as usual been obtained through the Calcutta Meteorological Office, only a small stock being kept at Allahahad. Full details are given in Appendices C, D, and E.[1] These tables do not include a number of raingauges obtained at the expense of the Provincial Government and issued to the revenue stations, for the most part, during the year under report.

The number of instruments broken or damaged during the year was small, the losses occurring chiefly among the radiation thermometers, which, being freely exposed, are very liable to accidents.

RAINFALL REGISTRATION.

New raingauges of Symons' pattern were issued during the year to all the revenue stations which send direct reports of rainfall to the central meteorological office, and a few spare ones are kept

[1] Appendix C of this report is incorporated in the general list in Appendix I. D is here numbered B IV, and E is omitted.

in stock. The new gauges are to be read for a year simultaneously with the old ones, before the latter are disused. In this way, it is hoped, that factors may be arrived at, which will enable us to deduce the true rainfall from the past observations of the old gauges.

My report on the rainfall of the province, published in the year 1878, having been out of print for some time, a new set of tables giving the approximate annual mean rainfall of 496 places in the province have been prepared, and the results laid down on a map which is being printed for general distribution among district and canal officers.

SPECIAL OBSERVATIONS.

In addition to the ordinary observations special observations of soil temperatures have been carried on during the year at Allahabad and Jeypore, and I believe also at Dehra, though the observations made at Dehra have not been communicated to the Allahabad office. At Allahabad the temperature is taken four times daily at half an inch, 1 foot, and 3 feet below the surface; and at Jeypore observations are made at the surface and at depths of 4 inches, 1 foot, 3 feet, 10 feet, and 20 feet. The results for the year under report are given in Appendices H and I.[1] Hourly observations of the earth thermometers were made at Allahabad on four days in each month, with the object of determining what corrections should be applied to the mean of the 4, 10, 16, and 22 hour observations to reduce them to the true daily mean. The deduced corrections are the following :—

Depth.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
½ Inch.	—0·4°	—0·4°	—0·5°	—0·4°	—1·1°	—0·3°	0·0°	—0·1°	—0·4°	—0·4°	—0·4°	—0·4°
1 Foot.	—0·04	—0·01	—0·03	—0·05	0·00	+0·01	—0·02	+0·00	+0·06	0·00	—0·03	0·00
3 Feet.	—0·01	0·00	—0·05	0·00	0·00	0·00	0·00	+0·01	+0·05	—0·01	—0·02	+0·01

These corrections have a sensible value for the thermometer nearest the surface, but for the others they are very small and irregular. The diurnal range at the depth of 1 foot is less than 2°, and at 3 feet depth it is almost insensible in some months, and does not average 0·2°. In the table for Allahabad. the temperatures at half an inch below the surface have been corrected for diurnal variation and the others are uncorrected. The figures for Jeypore are all uncorrected for this inequality.

Including the month of April 1883, we have, for Allahabad, a series of ground temperature observations extending over three complete years. In the following table, the corrected monthly means of the three thermometers and the mean temperature of the air are compared, the second column under each heading giving the means freed from annual inequality. During the two years from November 1880 to October 1882, it appears that the temperature both of the ground and of the air diminished by about 1·5°, the decrease being fairly steady and uniform, but greatest at the ground surface. On the average of all the observations the thermometer at a depth of 1 foot stands a degree lower than that at 3 feet, but is nearly identical with the corrected temperature at the surface. The high temperature at a depth of 3 feet is probably either due to a wave of heat which reached its maximum before the commencement of the series, or more likely to an error in the thermometer.

MONTH.	AIR IN SHADE.		GROUND ½ INCH BELOW SURFACE.		GROUND 1 FOOT DEEP.		GROUND 3 FEET DEEP.	
	Mean.	Corrected for annual inequality.	Mean.	Corrected for annual inequality.	Mean.	Corrected for annual inequality.	Mean.	Corrected for annual inequality.
	°	°	°	°	°	°	°	°
May 1880 . . .	91·3	......	98·0	......	94·6	......	89·4	......
June ,, . . .	94·2	......	100·1	......	97·0	......	92·8	......
July ,, . . .	83·1	......	86·2	......	87·7	......	88·7	......
August ,, . . .	84·2	......	87·6	......	87·3	......	87·0	......
September ,, . . .	82·6	......	86·4	......	86·8	......	87·0	......
October ,, . . .	79·9	......	87·1	......	84·8	......	86·0	......

---

[1] These are here omitted, but will be given in the report on the meteorology of the year.

Month.	Air in shade.		Ground ½ inch below surface.		Ground 1 foot deep.		Ground 3 feet deep.	
	Mean.	Corrected for annual inequality.	Mean.	Corrected for annual inequality.	Mean.	Corrected for annual inequality.	Mean.	Corrected for annual inequality.
	°	°	°	°	°	°	°	°
November 1880 . . .	66·4	77·52	72·7	82·90	73·5	81·59	79·9	82·20
December „ . . .	59·1	77·33	64·0	82·52	64·7	81·51	72·0	82·24
January 1881 . . .	58·2	77·17	63·0	82·14	62·9	81·37	68·8	82·19
February „ . . .	68·6	77·13	73·9	82·11	71·0	81·36	71·9	82·19
March „ . . .	74·0	77·07	79·8	82·07	77·8	81·36	77·4	82·21
April „ . . .	88·4	76·97	95·7	81·82	90·1	81·24	84·8	82·17
May „ . . .	91·8	76·80	98·5	81·37	96·3	80·98	90·9	82·02
June „ . . .	89·1	76·75	90·4	81·12	93·6	80·89	92·0	81·94
July „ . . .	84·3	76·85	86·8	81·06	87·6	80·96	88·4	82·02
August „ . . .	82·2	76·75	86·4	80·83	87·0	80·93	87·2	82·08
September „ . . .	83·1	76·80	86·7	80·64	87·2	80·87	87·4	82·07
October „ . . .	77·0	76·97	80·8	80·52	81·4	80·79	84·7	82·03
November „ . . .	65·1	76·86	68·2	80·22	70·8	80·51	77·6	81·88
December „ . . .	59·3	76·73	62·4	80·12	65·2	80·22	72·3	81·68
January 1882 . . .	60·4	76·65	63·3	80·12	64·2	80·09	70·4	81·54
February „ . . .	64·1	76·65	68·0	80·16	68·7	80·11	71·9	81·53
March „ . . .	79·6	76·65	81·3	80·26	78·8	80·16	77·2	81·52
April „ . . .	87·1	76·60	91·1	80·27	87·2	80·17	83·9	81·46
May „ . . .	90·2	76·54	96·0	80·23	92·5	80·25	88·3	81·43
June „ . . .	87·8	76·55	90·3	80·22	90·4	80·38	89·6	81·41
July „ . . .	83·5	76·54	87·1	80·17	87·7	80·45	87·7	81·38
August „ . . .	82·8	76·38	87·1	79·90	87·6	80·30	87·5	81·20
September „ . . .	82·8	76·07	88·5	79·44	87·5	79·96	86·9	80·91
October „ . . .	76·0	75·99	79·2	79·21	81·6	79·76	83·9	80·70
November „ . . .	64·7	......	68·6	......	72·5	......	77·4	......
December „ . . .	60·0	......	62·0	......	66·5	......	72·1	......
January 1883 . . .	59·5	......	62·2	......	64·8	......	69·9	......
February „ . . .	60·9	......	62·7	......	64·4	......	68·1	......
March „ . . .	75·6	......	75·6	......	74·8	......	74·0	......
April „ . . .	89·0	......	91·5	......	86·4	......	82·0	......
Mean for 3 years . . .	76·8	......	80·8	......	80·6	......	81·6	......

The excess temperature of the ground above that of the air at Allahabad is between 4 and 5 degrees. At Jeypore, the observations have not been continued long enough to give true average temperatures, but on the mean of the twelve months in the table, the average temperature of all the earth thermometers, except that at the surface, which requires a correction for diurnal inequality, was 4·2 degrees higher than that of the air. A similar excess having been found at Trevandrum, Calcutta, and Allahabad, it may be inferred with much probability to hold over the whole of India.

A self-acting sunshine recorder was brought into use in April 1882, and its traces have been filed for every day in the year except three. In the table in Appendix B. VII the percentage of bright sunshine recorded is compared with that of clear sky deduced from cloud observations at 10 A.M. and 4 P.M.

In all the months, except April and May, the percentage of recorded sunshine is considerably in excess, thus suggesting, as is not improbable, that the rays of the sun have a very considerable effect in dispelling cloud from his path across the sky. In April and May, when the air is full of dust, the recorded sunshine is defective, because when the sun is near the horizon, especially in the evening, his rays are so scattered by the dust particles, that the heat, concentrated in the focus of the lens, is not sufficient to burn the recording card.

In the clear weather at the close of the rains, on the other hand, the recorded sunshine frequently exceeds 100 per cent., no allowance having been made for refraction in computing the theoretical length of the day.

OFFICE AND OFFICE WORK.

The work of the office has been carried on by the same staff as in the previous year. The ordinary work has been kept fairly well up to date, the registers for each month being prepared and an abstract of the observations published before the end of the succeeding month or early in the second month after. The preparation of copies of the registers for transmission to the Calcutta office has however been a good deal delayed, the last registers for 1882 having been despatched as late as April 1883. As mentioned in last year's report, proposals for a slight increase in the office establishment were sent up during the year, but sanction has not yet been obtained. The establishment at present is the following :—

Name and Designation.	Monthly pay.
	Rs.
Chinta Money Ghosh, Head Clerk	88
Kaliprosono Datta, Second „	50
Makhan Lal Mukerji, Third „	30
Ram Charan Pande, Fourth „	20
Sasi Bhusan Banerji, Fifth „	20
And one peon	6

In addition to the usual monthly meteorological abstracts and the weekly and annual rainfall statements, a brief sketch of the meteorology of 1881 was prepared for the Provincial Administration Report, and a few spare copies were printed and circulated. The rainfall tables and map already mentioned were also prepared during the year, and I have written a paper on the temperature of North-Western India, which is now being printed for the *Meteorological Memoirs.*

COST OF THE DEPARTMENT.

Details of the cost of maintaining the Meteorological office and the observatories in the North-Western Provinces and Oudh, are given in the last statement in the Appendix. The total expenditure, paid by the Government of India, exceeds that for the previous year by Rs. 1,087-12-3. This is accounted for by the addition of Pithoragarh to the list of paid observatories, the special allowances given to deserving observers, a slight increase of pay to the head clerk of the office, and the maintenance of the observatory buildings, formerly paid for partly by the Provincial Government.

S. A. HILL,
Meteorological Reporter to Govt., N.-W. P. and Oudh.

ALLAHABAD :
The 3rd May 1883.

APPENDIX B. II.

Meteorological Observatory, Jeypore.

[Extract from Dr. Hendley's Report.]

During the past year the observatory has become practically one of the first class, as automatic readings of all the ordinary instruments have been more or less regularly recorded by the Meteorograph since August. In addition to the five soil thermometers in use in 1881 a sixth has been added to record the temperature at a depth of 20 feet.

The anemograph has yielded traces without interruption during the year.

Meteorograph.—The tower for the Van Rysselberghe Meteorograph was ready for the installation of the instrument early in May, but it was found impossible to get it into working order in less than three months. Owing to the motor having been packed in England with the springs half uncoiled, one of them had been broken, and much damage had been done to the delicate mechanism of the driving part of the instrument.

The skill of the Telegraph Master, Mr. Callaghan, who has been permitted to act as Electrician, and of Nund Kishore, an unusually clever native workman, alone enabled this and many other difficulties to be overcome. A careful statement of many practical points regarding the instrument not mentioned in the account published by the makers, has been prepared for the help of those who may have to erect another meteorograph in India.

Enclosure.—The railed enclosure round the ordinary instruments has been enlarged and a mud wall constructed to the compound.

Daily weather telegrams have been despatched throughout the year to Simla or Calcutta. The Meteorological Reporters to the Government of India and the North-Western Provinces have both inspected the observatory during the period under review.

Observers.—The observers have worked well, their salaries have been raised, and it is proposed to increase them by regular increments if they are favourably reported on.

General Remarks.—His Highness the Maharaja has visited the meteorological observatory on several occasions, and has shown much interest in all the institutions.

APPENDIX B. III.

Names of the Superintendents and of the Observers at the Meteorological Observatories in North-Western Provinces and Oudh during the year 1882-83.

Observatory.	Class.	Officer in charge.	Date.		Observers.	Date.		Remarks.
			From	To		From	To	
Allahabad	Second	S. A. Hill, Esq.	1st April 1882	31st March 1883	Kedar Nath Chatterji, Observer	1st April 1882	31st March 1883.	
					Jadu Nath Chatterji, Observer, at the new observatory	Ditto ,,	Ditto ,,	
					Sasi Bhusan Banerji, Officiating Assistant Observer	Ditto ,,	Dttto ,,	
Agra	Ditto	Dr. A. H. Hilson	Ditto ,,	Ditto ,,	Mir Altaf Ali, Observer	Ditto ,,	23rd April 1882.	
					Syed Aziz-ud-din, Officiating Observer	24th April ,,	23rd July ,,	
					Mir Altaf Ali, Observer	24th July ,,	31st March 1883.	
					Abdul Majid Khan, Assistant Observer	1st April ,,	Ditto ,,	
Lucknow	Ditto	Dr. J. C. Whishaw	Ditto ,,	6th August 1882	Chotay Lal, Observer	Ditto ,,	Ditto ,,	
		Dr. J. Cameron	7th Aug. ,,	16th Sept ,,	Durga Parshad, Assistant Observer	Ditto ,,	Ditto ,,	
		Dr. J. C. Whishaw	17th Sept. ,,	31st March 1883.				
Roorkee	Ditto	Dr. Murray Thomson	1st April ,,	4th April 1882	Chiranji Lal, Observer	Ditto ,,	Ditto ,,	
		Lieutenant G. Onslow, R.E.	5th ,, ,,	7th July ,,				
		Dr. Murray Thomson	8th July ,,	31st March 1883	Tulsi Ram, Assistant Observer	Ditto ,,	Ditto ,,	
Jeypore	First	Dr. T. H. Hendley	1st April ,,	Ditto ,,	Durga Parshad, Observer	Ditto ,,	Ditto ,,	
					Gunga Ram, Assistant Observer	Ditto ,,	Ditto ,,	
					Nathu Narain, ditto	Ditto ,,	Ditto ,,	
Chakrata	Third	Captain A. E. Ward	Ditto ,,	Ditto ,,	Saligram	Ditto ,,	Ditto ,,	
Pauri	Ditto	Revd. J. T. McMahon	Ditto ,,	Ditto ,,	Revd. F. W. Greenold	Ditto ,,	20th Dec. 1882.	
					E. Thomson	21st Dec. ,,	21st Jan. 1883.	
					Revd. F. W. Greenold	22nd Jan. 1883	31st March ,,	
Pithoragarh	Ditto	Revd. Dr. R. Gray	Ditto ,,	Ditto ,,	Sher Singh	1st April 1882	4th June 1882.	
					Revd. Dr. R. Gray	5th June ,,	5th July ,,	
					Sher Singh	6th ,, ,,	31st March 1883.	

Names of the Superintendents and of the Observers at the Meteorological Observatories in North-Western Provinces and Oudh during the year 1882-83—(continued).

Observatory.	Class.	Officer in charge.	Date. From	Date. To	Observers.	Date. From	Date. To	Remarks.
Ranikhet	Third	No Superintendent	......	......	Jewa Nand	1st April 1882.	31st March 1883.	
Dehra	Ditto	J. B. N. Hennessey, Esq.	1st April 1882	31st March 1883	The Head Computers	Djtto ,,	Ditto ,,	
Meerut	Ditto	Dr. W. P. Harris	Ditto ,,	4th July 1882	Harsaran Das	Ditto ,,	Ditto ,,	
		Dr. G. S. Robertson	4th July ,,	10th Sept. ,,				
		Dr. L. A. Waddell	11th Sept. ,,	26th ,, ,,				
		Dr. G. S. Robertson	27th ,, ,,	1st October ,,				
		Dr. M. O. Dwyer	2nd Oct. ,,	10th Nov. ,,				
		Dr. G. S. Robertson	11th Nov. ,,	2nd March 1883.				
		Dr. W. Moir	3rd March 1883	31st ,, ,,				
Bareilly	Ditto	E. A. Phillips, Esq.	1st April 1882	17th May 1882	Jawla Parshad	1st April 1882	20th Nov. 1882.	
		No Superintendent	18th May ,,	30th June ,,	Sundar Lal	21st Nov. ,,	31st Jan. 1883.	
		E. A. Phillips, Esq.	1st July ,,	31st March 1883	Jawla Parshad	1st Feb. 1883	31st March ,,	
Gorakhpur	Ditto	Dr. C. Prentis	1st April ,,	Ditto ,,	Nizam-ud-din	1st April 1882	Ditto ,,	
Benares	Ditto	Dr. G. Thibout	Ditto ,,	Ditto ,,	Devakinandan Pathak	Ditto ,,	Ditto ,,	
Ghazipur	Ditto	Dr. P. A. Weir	Ditto ,,	Ditto ,,	Babu Kunjan	Ditto ,,	Ditto ,,	
Sutna	Ditto	Surgeon S. J. Goldsmith	Ditto ,,	17th April 1882	Har Nath	Ditto ,,	8th Feb. ,,	
					Ram Sahai	9th Feb. 1883	13th Feb. ,,	
		Surgeon C. G. W. Rodwell	18th ,, ,,	31st March 1883	Har Nath	14th ,, ,,	31st March ,,	
Nowgong	Ditto	J. Mather, Esq.	1st ,, ,,	3rd June 1882				
		Roshan Lal	4th June ,,	8th Aug. ,,	Karim Baksh	1st April 1882	30th June 1882.	
					Mannu Singh	1st July ,,	31st Aug. ,,	
		A. P. Mitchell, Esq.	9th Aug. ,,	31st March 1883	Baldeo Singh	1st Sept. ,,	31st March 1883.	
Sambhar	Ditto	W. Lyon, Esq.	1st April ,,	31st Aug. 1882				
		W. Poulter, Esq.	1st Sept. ,,	31st March 1883	J. Romare	1st April ,,	Ditto ,,	
Jhansi	Ditto	Surgeon G. M. Nixon	1st April ,,	25th Oct. 1882	Kalka Dass	Ditto ,,	Ditto ,,	
		Surgeon-Major L. E. Eades	26th Oct. ,,	31st March 1883.				
Ajmere	Ditto	Dr. J. H. Newman	1st April ,,	Ditto ,,	Ram Parshad	Ditto ,,	Ditto ,,	

APPENDIX B. IV.

Return of Instruments broken or otherwise injured at the Observatories in N.-W. P. and Oudh during the year 1882-83.

STATION.	Grass radiation thermometer.	Solar radiation thermometer.	Maximum thermometer (for shade).	Wet minimum thermometer.	Anemometer.	REMARKS.
Roorkee	1	...	...	...	...	
Meerut	1	...	...	1	...	
Agra	*2	...	...	...	...	* One of the instruments broken in transit.
Allahabad (old) Observatory	1	...	...	...	...	
Gorakhpur . . .	...	...	...	1	...	
Benares	...	...	‡1	...	†1	† Teeth of the instrument worn out. ‡ Stolen.
Nowgong	1	1	...	...	...	
Sambhar	...	1	...	...	...	

APPENDIX B. V.

Comparison of Shade Temperature at the new Observatory, Muir College, Allahabad, with those simultaneously recorded at the old site.

MONTH.	MEAN TEMPERATURE.[1]			MEAN AT 10 A.M.			MEAN AT 4 P.M.			MEAN MAXIMA.			MEAN MINIMA.			MEAN DAILY RANGE.		
	New.	Old.	Diff.	New.	Old.	Diff.	New.	Old.	Diff.	New.	Old.	Diff.	New.	Old.	Diff.	New.	Old.	Diff.
May 1882 . . .	90·1	90·5	—0·4	94·0	95·1	—1·1	101·5	101·9	—0·4	103·4	104·4	—1·0	77·3	76·9	+0·4	26·5	27·5	—1·0
June ,, . . .	87·8	87·6	+0·2	89·4	89·5	—0·1	94·5	93·8	+0·7	96·1	95·7	+0·4	80·4	80·5	—0·1	15·7	15·2	+0·5
July . ,, . . .	83·7	83·5	+0·2	85·8	85·4	+0·4	87·2	86·9	+0·3	90·7	90·1	+0·6	78·6	78·9	—0·3	12·1	11·2	+0·9
August ,, . . .	83·2	83·0	+0·2	85·0	84·9	+0·1	87·6	86·9	+0·7	91·1	90·4	+0·7	78·6	78·7	—0·1	12·4	11·7	+0·7
September ,, . . .	84·0	82·8	+1·2	87·0	86·2	+0·8	90·6	88·6	+2·0	93·3	91·8	+1·5	77·0	76·6	+0·4	16·3	15·2	+1·1
October ,, . . .	77·5	75·9	+1·6	83·0	80·8	+2·2	89·2	86·2	+3·0	91·0	88·9	+2·1	66·8	66·6	+0·2	24·2	22.3	+1·9
November ,, . . .	66·2	64·7	+1·5	73·3	70·5	+2·8	79·3	76·0	+3·3	81·4	79·5	+1·9	53·5	54·4	—0·9	27·9	25·1	+2·8
December ,, . . .	61·4	59·9	+1·5	67·6	65·1	+2·5	76·8	73·3	+3.5	78·8	76·7	+2·1	47·3	48·2	—0.9	31·5	28·5	+3·0
January 1883 . . .	61·1	60·1	+1·0	64·7	63·0	+1·7	71·7	69·7	+2·0	73·1	72·1	+1·0	48·6	49·4	—0·8	24·5	22·7	+1·8
February ,, . . .	62·8	61·7	+1·1	66·5	64·8	+1·7	75·8	74·3	+1·5	78·0	76·4	+1·6	47·9	47·9	0·0	30·1	28·5	+1·6
March ,, . . .	76·9	76·0	+0·9	81·4	80·6	+0·8	89·7	88·5	+1·2	90·8	90·3	+0·5	61·3	60·7	+0·6	29·5	29·6	—0·1
April . {1st—15th 1883 16th—30th 1882}	89·2	89·7	—0·5	95·3	95·8	—0·5	102·6	102·5	+0·1	103·2	104·8	—1·6	71·5	70·8	+0·7	32·8	34·0	—1·2
Year . . .	77·0	76·3	+0·7	81·1	80·1	+1·0	87·2	85·7	+1·5	89·2	88·4	+0·8	65·7	65·8	—0·1	23·6	22·6	+1·0

---

[1] Computed from the 10 A.M., 4 P.M., and Minimum readings by means of range factors founded on the hourly observations of several years.

APPENDIX B. VI.

Comparative Observations of Atmospheric Humidity at the old and new Observatorios, Allahabad.

MONTH.	VAPOUR TENSION IN INCHES OF MERCURY.						RELATIVE HUMIDITY OR PERCENTAGE OF SATURATON.					
	MEAN.[1]			AT 10 A.M.			MEAN.[1]			AT 10 A.M.		
	New.	Old.	Diff.	New.	Old.	Diff.	New.	Old.	Diff.	New.	Old.	Diff.
May 1882 . .	·444	·458	—·014	·466	·490	—·024	33	35	—2	29	32	—3
June ,, . . .	·804	·834	—·030	·824	·847	—·023	62	67	—5	59	65	—6
July ,, . . .	·935	·956	—·021	·951	·983	—·032	81	83	—2	77	81	—4
August ,, . . .	·878	·911	—·033	·893	·941	—·048	77	80	—3	74	78	—4
September ,, . . .	·815	·858	—·043	·840	·892	—·052	70	75	—5	66	72	—6
October ,, . . .	·578	·621	—·043	·596	·631	—·035	60	67	—7	53	59	—6
November ,, . . .	·364	·418	—·054	·377	·418	—·041	58	66	—8	48	57	—9
December ,, . . .	·306	·334	—·028	·317	·343	—·026	57	62	—5	46	55	—9
January 1883 . . .	·354	·367	—·013	·372	·381	—·009	68	71	—3	60	66	—6
February ,, . . .	·276	·288	—·012	·277	·288	—·011	53	56	—3	43	47	—4
March ,, . . .	·334	·341	—·007	·350	·346	+·004	42	43	—1	35	36	—1
April 1st—15th 1883, 16th—30th 1882	·306	·343	—·037	·314	·360	—·046	26	29	—3	15	22	—7
Year . . .	·533	·561	—·028	·548	·577	—·029	57	61	—4	50	56	—6

[1] Crude mean of the 10 A.M., 4 P.M., and minimum observations.

APPENDIX B. VII.

Comparison of Sunshine and Cloud Observations at Allahabad.

MONTH.	Duration of bright sunshine in hours.	Number of hours during which the sun was above the horizon.	Percentage of bright sunshine.	Percentage of cloud at 10 A.M. and 4 P.M.	Percentage of clear sky.	REMARKS.
April 1882	334·01	378·96	88·2	10·8	89·2	
May ,, . . .	322·40	410·43	78·6	19·4	80·6	
June ,, . . .	218·65	406·97	53·8	57·0	43·0	
July ,, . . .	181·07	416·12	43·5	77·1	22·9	
August ,, . . .	144·76	400·02	36·2	81·4	18·6	
September ,, . . .	251·92	365·71	68·8	50·2	49·8	
October ,, . . .	*295·81	*331·81	89·4	18·6	81·4	*2 days wanting.
November ,, . . .	268·33	323·81	82·9	21·2	78·8	
December ,, . . .	†282·61	†313·26	90·2	3·5	96·5	†1 day wanting.
January 1883 . . .	258·63	328·89	78·7	26·6	73·4	
February ,, . . .	272·91	312·39	87·4	27·5	72·5	
March ,, . . .	305·91	368·13	83·1	27·1	72·9	
Year	3,137·01	4,356·50	73·4	35·0	65·0	

APPENDIX C.

Administration Report of the Meteorological Reporter to the Punjab Government for 1882-83.

During the year 1882-83, the work of the Meteorological Department, Punjab, excepting that of sending telegrams, was carried on in the same manner as last year; no new observatories were established, nor were any of the old ones suppressed; there were thus, as before, twelve observatories under this office. Two of them are 2nd class and ten 3rd class.

The year under report showed considerable improvement in the character of work of all the observatories under my charge, and I have little or no complaint against any of the observers. The only observatory where many mistakes occurred was Rawalpindi; but on the whole the registers received from the observers throughout the province were superior to those of former years.

2. The work ot the office has greatly increased. Besides the regular routine work of correcting and reducing the meteorological observations recorded at twelve stations, this office has to make annual report of the climate of the Punjab for the Local Government, and monthly abstract sheets for the Sanitary Commissioner for Punjab, a copy of which is always forwarded to the Meteorological Reporter, India.

3. With this increase of work the amount of correspondence has more than kept pace, so that the number of letters sent out has doubled during the last three years.

4. Most of the observers in the Punjab retained the meritorious allowances granted to them last year during the current. Three more meritorious allowances were granted for 1883-84 to Jasput Rai, Divan Chand, and Mr. Cruickshank on account of the generally good character of their work. The observatories inspected during the year were as follows:—*Simla, Delhi, Ludhiana, Rawalpindi, Murree*, and *Dera Ismail Khan.* All of them were found in satisfactory order; two of the observatories, Murree and Dera Ismail Khan, were supplied with new barometers at the time of inspection.

5. The observatory at Lahore still works as 2nd class observatory; though it is under my superintendence, it is in immediate charge of the chief observer here, Jasput Rai, and is always in first rate order.

6. The work of inspection was unfortunately incomplete during the year under report, owing to my duties in the medical school. I am never able to leave the station in the cold weather, and last year the only time I could get away to visit the observatories was in the middle of September. On reaching Rawalpindi on my way to Peshawar, I found the line between *Pindi* and *Attock* was impassable owing to heavy floods, and after inspecting Murree I was obliged to return to Lahore and was unable to leave head-quarters again afterwards. As in former years, I found generally at the observatories, which I inspected, that the work of the observers is not performed by the men who are paid for it; at Delhi my friend Dr. Ross, the Civil Surgeon, has informed me that the Assistant Surgeon who draws the pay has taught and pays the dispensary clerk to take the observations, and I believe this is the rule in most of the other observatories, where the observers are Assistant Surgeons, though they have not always the honesty to confess it. At the request of Dr. Ross, the dispensary clerk will be appointed to take the meteorological observations at Dehli during the ensuing year; and if he does the work well, the same plan will be introduced in other observatories. The monthly pay of Rs. 15 is not sufficient to induce men of the Assistant-Surgeon class to do the meteorological work properly. But it is a very considerable sum to their subordinates, who are moreover constantly on the spot and more amenable to the authority of the Superintendents of the observatories, and therefore this plan ought to work well.

7. The most important work in connection with the observatories is that of inspection. I should like to make my chief observer in Lahore, who is a reliable man, travel about inspecting the observa-

tories frequently throughout the year. This would add very little to the expense of the Department, while it would add very largely to its efficiency.

8. Specified tables for the instruments issued and broken,[1] and observers and Superintendents of the observatories (C II), are herewith appended.

E. LAWRIE, M.B.,
Meteorological Reporter for Punjab.

LAHORE;
The 15th June 1883.

---

[1] This list has been inserted in the general list, Appendix I.

APPENDIX C. II.

Table showing the Names of the Superintendents and Observers at the Meteorological Observatories in the Province of Punjab during the year 1882-83.

No.	Observatories.	Class.	Names of Superintendents.	PERIOD.		Names of Observers.	PERIOD.		ALLOWANCES.	
				From	To		From	To	Monthly allowances.	Meritorious allowances.
1	LAHORE	II	Dr. E. Lawrie, M.B., Meteorological Reporter for Punjab	Throughout		Babu Jasput Rai, Chief Observer, and Divan Chand, Assistant	Throughout		20 10	5 5
2	DELHI	III	G, Ross, Surgeon-Major	Ditto		Asst.-Surgeon Ramkishen Asst.-Surgeon Gokul Chand Asst.-Surgeon Ramkishen	1st April 1882 8th Nov. 28th March	7th Nov. 1882 27th Mar. 1883 31st March	15	...
3	LUDHIANA	III	Brigade Surgeon R. Rouse	Ditto		Bhugwan Das Heera Lal Chatterji Bhugwan Das	1st April 13th Augt. 5th Oct.	12th August 4th Oct. 31st March	15	...
4	MULTAN	III	Surgeon M. R. Gray Asst.-Surgeon Jaswant Rai S. M. W. Jackson S. M. J. Bennet	1st April 10th April 24th April 16th Jany.	9th April 23rd April 15th Jany. 31st March	Mir Wahid Ali	Throughout		15	...
5	DERAH ISMAIL KHAN	III	Dr. T. Robinson, M.B. Dr. Ped. H. Haig Dr. A. W. Mackenzie Dr. Hde. H. Haig	1st April 1882 25th July 1882 28th July „ 30th Oct.	24th July 1882 27th July 1882 29th Oct. 31st March	Noor Bukhsh	Ditto		15	...
6	SIRSA	III	Dr. R. Crossby A. Sobha Ram R. Crossby	1st April 27th Feby. 13th March	26th Feb. 12th March 31st March	Hospital Assistant. Fazaloor Rahman Sham Sunder	1st April 17th March	16th Mar. 1883 31st March	15	5
7	SIALKOT	III	Thomas S. Veal	Throughout		Asst.-Surgeon Fatteh Singh Sardar Khan Fatteh Singh	1st April 4th July 11th Sept.	3rd July 10th Sept. 31st March	15	
8	MURREE	III	Revd. G. C. Peak	Ditto		Mr. W. Cruickshank	Throughout		15	5
9	SIMLA	III	Quarter-Master General, India	Ditto		J. W. Peart	Ditto		15	
10	PESHAWAR	III	S, W. Coates	Ditto		Kashi Ram Sita Ram Kashi Ram	1st April 1st August 1st Nov.	31st July 31st Oct. 31st March	15	5
11	LEH	II	N. Elias, Joint British Commissioner	......	......	Hira Lal Ramzan Bukhsh Lassgass	1st April 23rd Sept. 1st Nov.	22nd Sept. 31st Oct. 31st March	20*	5[1]
						Bholanath, Assistant	Throughout		15	5
12	RAWALPINDI	III	S. M. G. Massay Dr. T. R. Malrony S. M. G. Massay	1st April 16th July 16th August	15th July 15th August 31st March	Asst.-Surgeon Jaggan Nath Asst.-Surgeon Bhugwan Das	1st April 12th Nov.	11th Nov. 31st Mar. 1883	15	

---

[1] Rupees 5 meritorious allowance were only given to Hira Lal on account of his being very punctual to his duty of observations.

LAHORE:
The 15th April 1883.

E. LAWRIE, M.B.,
Meteorological Reporter to the Govt. of Punjab.

APPENDIX D.

Extracts from the Administration Report of the Sanitary Commissioner, Central Provinces.

I have the honour to forward the Meteorological Report of the Central Provinces for the year ending 31st March, as called for in your letter of 8th March 1883.

2. I have not myself inspected any of the observatories, as I took charge on the 2nd April 1883.

3. There are in the Central Provinces three 2nd class observatories—

Nagpur,
Jubbulpore,
Pachmarhi,

and eight 3rd class observatories—

Chanda,
Saugor,
Seoni,
Hoshangabad,
Khandwa,
Raipur,
Sambalpur,
Sironcha.

4. *Nagpur.*—The Superintendent reports that the shed was damaged by a storm; also that the observer, Alligherry Swamy, has been rewarded by a grant of Rs. 10 per mensem extra pay since April 1882.

5. *Jubbulpore.*—The Superintendent reports that no definite orders have as yet been received regarding the erection of the proposed new thermometer shed in the civil dispensary compound, also that no orders have been received regarding the transference of the anemograph from the dispensary tower to the jail tower. The observatory has got two new instruments. Solar radiation thermometer in use since 7th February, and anemoscope in use since 18th March. The Superintendent regrets that he has to report that the observer is wanting in punctuality.

6. *Pachmarhi.*—The Superintendent reports that the barometer was removed into the room for anemograph on 1st September.

The observer's conduct and qualifications are good.

7. *Chanda.*—The Superintendent reports that two new instruments were received, one instrument was broken.

The observer's conduct and qualifications are good.

8. *Saugor.*—The Superintendent reports that no instruments were received or broken.

The observer's conduct and qualifications are good.

9. *Seoni.*—The Superintendent reports that no instruments were received or broken.

The observer is very favourably reported on by the Superintendent and has been promoted from 1st April 1883.

10. *Hoshangabad.*—The Superintendent reports that a barometer on the Kew principle has been received to replace a mountain barometer which got out of order and was returned to the Meteorological Reporter's office. Also a new solar radiation thermometer to replace one broken. The old solar radiation thermometer is supposed by the Superintendent to have been maliciously broken,—*vide* his letters of 5th and 15th August 1882.

The conduct and qualifications of the observer are good.

* * * * *

11. *Khandwa* (*Nimar*).—The Superintendent reports that no instruments have been received or broken.

The conduct and qualifications of observer are good.

12. *Raipur.*—The Superintendent reports that a fence has been put up round the shed to prevent cattle trespassing.

A new barometer on Fortin's principle was received, and brought into use on 16th June 1882.

A new grass radiation thermometer was brought into use on 9th March. Advice was received on 20th March of the despatch of a new solar radiation thermometer.

One instrument was broken—a solar radiation thermometer. The accident occurred on 7th March owing to a severe hail-storm, which came on very suddenly.

The Superintendent reports very favourably of the observer's conduct and qualifications and recommends his promotion.

13. Sambalpur.—The following instruments have been received :—

Hygrometer, maximum thermometer, dry minimum, wet minimum, grass radiation and solar radiation thermometers, rain gauge 5 inches and measure glass, sun thermometer stand, pad for grass radiation thermometer, and thermometer cage.

No instruments have been broken during the year.

The observer's conduct and qualifications are good.

The Superintendent recommends that the enclosure should be surrounded with large mesh wire fencing instead of the present enclosure of wooden posts and bamboos which he says hardly lasts one season.

14. Sironcha.—A new thatch was put over the observatory shed, and the ladder leading to the anemometer was repaired at an expense of Rs. 30 sanctioned for the same.

No new instruments were received. The time-piece got out of order on the 4th July and was sent to Nagpur to the Sanitary Commissioner's office for repairs.

* * * * *

The observer, Hospital Assistant T. Muthoo Krishna Naidu, is favourably reported on by the Superintendent, Haran Chunder Dutt, Assistant Surgeon in medical charge of the Sironcha station.

15. The sub-division of Sironcha has been abolished with effect from 1st April 1883, and there will not in future be any Assistant Surgeon posted there. On the 2nd April 1883, Dr. Simpson, Deputy Surgeon-General, recommended that the tahsildar of Sironcha should be appointed Superintendent of the observatory. This has been sanctioned by the Chief Commissioner, Central Provinces, in letter No. 1492-79 of 10th April 1883.

W. WATSON, M.D.,

Offg. Deputy Surgeon-General and
Sanitary Commr., Central Provinces.

APPENDIX D. II.

Names of the Superintendents and Observers at the Meteorological Observatories in the Central Provinces during the year 1882-83.

Observatory.	Class.	Officer in charge.	Date.		Observers.	Date.		Remarks.
			From	To		From	To	
					T. V. Allagheri Swamy	1st April 1882	8th Sept. 1882	On 6 months' leave on private affairs.
					T. Soobiah	9th Sept. ,,	8th Mar. 1883	
					T. V. Allagheri Swamy	9th Mar. 1883	31st Mar. ,,	
Nagpur	Second	Surgeon-Major R. T. Wright, M.D.	1st April 1882	31st Mar. 1883				
					Assistant Observers.			
					T. Soobiah	1st April 1882	8th Sept. 1882	
					T. Ramchurn	9th Sept. ,,	8th Mar. 1883	
					T. Soobiah	9th Mar. 1883	31st Mar. ,,	
					Bani Kanta Ray Chowdhri	1st April 1882	30th June 1882	
					Pandit Saduram Dubay	1st July ,,	31st Mar. 1883	
Jubbulpore	Ditto	Surgeon-Major W. R. Rice, M.D.	1st April 1883	31st Mar. ,,				
					Assistant Observer.			
					Hospital Assistant Kunj Behari Lal	1st April ,,	31st Mar. ,,	
					Madho Rao	1st April ,,	31st Mar. ,,	
Pachmarhi	Ditto	R. H. Finch, Esq.	1st April 1882	14th May 1882				
		A. C. Duff, Esq.	15th May ,,	16th June ,,				
		F. A. T. Phillips, Esq.	17th June ,,	17th Jan. 1883				
		A. C. Duff, Esq.	18th Jan. 1883	31st Mar. ,,				
					Assistant Observers.			
					Narain Bhagwant	1st April ,,	16th Nov. 1882	
					Kesho Rao	17th Nov. ,,	31st Mar. 1883	
Saugor	Third	Surgeon-Major J. W. Strong	1st April 1882	31st ,, ,,	Deendyal Pathuck	1st April ,,	4th June 1882	
					Sado Rao Pathuck	19th Oct. ,,	31st Mar. 1883	
Hoshangabad	Ditto	Surgeon S. H. Browne, M.D.	1st ,, ,,	31st ,, ,,	Jadu Nath Bose	1st April ,,	31st Mar. ,,	
Khandwa	Ditto	Surgeon-Major P. Cullen, M.D.	1st ,, ,,	31st ,, ,,	Behari Lal Parasar	1st April ,,	31st Mar. ,,	
Seoni	Ditto	,, J. B. Gaffney	1st ,, ,,	31st ,, ,,	Punchum	1st April ,,	31st Mar. ,,	
Chanda	Ditto	Surgeon H. Armstrong	1st ,, ,,	17th July 1882				
		Asst. Surgeon Omesh Chunder Mitter	18th July ,,	17th Oct. ,,	Seetaram	1st April ,,	31st Mar. ,,	
		Surgeon H. Armstrong	18th Oct. ,,	31st Mar. 1883				
Sironcha	Ditto	Haran Chunder Dutt	1st April ,,	31st ,, ,,	Haran Chunder Dutt	1st April ,,	9th May 1882	
					T. Muthu Krishna Naidu	10th May ,,	31st Mar. 1883	
Raipur	Ditto	Surgeon-Major D. W. Trimnell	1st ,, ,,	31st ,, ,,	Krishna Rao	1st April ,,	31st Mar. ,,	
Sambalpur	Ditto	Honorary Surgeon J. E. Harrison	1st ,, ,,	31st ,, ,,	Babu Sham Soondur Das	1st April ,,	31st Mar. ,,	

APPENDIX D. III.

Notes on the Inspection of Observatories in the Central Provinces.

Khandwa twice inspected—last rains, and in March 1883.

A new shed is being sanctioned with wire fencing and stone posts. The old structure is in a very rickety condition, and may at any time come to grief; all instruments in order.

A new barometer room close to the shed is being built.

Jubbulpore.—Inspected in November last. The anemograph had been erected on the tower of the main dispensary. Site good, but instrument would not work owing to increased length of chain rendered necessary by distance between the instrument and the table. I arranged to have it erected on one of the jail towers.

All the instruments in good order and clean. Pluviometer, however, is not the right height from the ground.

I observed that the cup of water for feeding the wet bulb was suspended above the bulb instead of below it as ordered. Dr. Rice and the observer both assured me that they found if this were not done, the bulb could not be kept moist in the west (hot) winds. The water used is rain water, and the wick and the muslin were regularly changed. No other observer has found this difficulty. At Khandwa, where the hot winds blow with greater force than Jubbulpore, it is not observed. So it is difficult to account for, except on the supposition that the muslin is tied too tight.

Seoni.—Everything was found in order at my inspection in November. Instruments clean and books well kept. The observer here was passed over by Mr. Blanford (see correspondence), but has been recommended by me for promotion this year.

Nagpur.—Everything in order. I inspected this observatory on 15th May last.

Sambalpur.—The observatory shed (eaves too low, 3 feet 5 inches) is being removed, as the extensions to the jail will encroach on it.

The barometer was kept in the jail, and this was objected to by the Superintendent on the ground of its being inconvenient to allow the observer access at all hours. An old magazine is now being turned into a barometer room. The instrument I found badly placed, (light coming from behind), and not high enough from the ground. It is an old mountain barometer. The mercury was much oxidized. I took it out, filtered it, and cleaned the cistern.

The anemometer did not work properly, owing chiefly, I think, to its being loose. I remedied this, and I understand it works well now.

The pluviometer was not at the right height from the ground. Measurements showed it to be 15½ inches.

Arrangements for grass radiation thermometer defective. Cloth pad hardly necessary in Sambulpur.

Raipur.—Instruments in good order except barometer, the mercury of which was so much oxidized that I had to clean it.

Chanda.—Position of wind vane very objectionable, surrounded by high trees on three sides. Instruments in good order; barometer not the proper height from ground,—too low.

Sun radiation thermometer has ½ degree of mercury fixed in end of tube. This has not been allowed for in the observations.

B. SIMPSON, M.D.,
Deputy Surgeon-General and Sanitary
Commissioner, Central Provinces.

APPENDIX E.

List showing the names of the Superintendents and Observers at the Meteorological Observatories, reporting immediately to the office of the Meteorological Reporter to the Government of India during the year 1882-83.

Observatories.	Class.	Names of Superintendents.	Period.		Names of Observers.	Period.	
			From	To		From	To
Aden	3rd	Major F. M. Hunter	1st April 1882	27th June 1882			
		Captain C. W. H. Sealy	28th June ,,	21st Sept ,,	Mr. D. C. Coutinho	1st April 1882	31st Mar. 1883.
		Major F. M. Hunter	22nd Sept. ,,	10th Dec. ,,	Shaik Ebrahim	1st April ,,	31st Mar. ,,
		Captain C. W. H. Sealy	11th Dec. ,,	31st Mar. 1883			
Bushire	3rd	......	......	......	Not known	1st April ,,	31st Mar. ,,
Quetta	3rd	J. C. Fullerton, M.B.	1st April 1882	31st Mar. 1883.	A. Samuel Pillay	1st April ,,	31st Mar. ,,
Pachbudra	3rd	Mr. A. R. Shaw	1st April ,,	26th Jan. ,,	Babu Birdhi Chund	1st April ,,	30th Sept. 1882.
		Mr. G. A. Bradford	27th Jan. 1883	31st Mar. ,,	Mr. P. Holder	1st Oct. ,,	31st Mar. 1883.
Mussooree	3rd	Father Genesius	1st April 1882	30th Sept. 1882	Brother Joseph	1st April ,,	31st Mar. ,,
		Father Lawrence McCarthy	1st Oct. ,,	31st Mar. 1883			
Katmandu	3rd	......	......	......	Pashuput Sharan Sinha	1st April ,,	31st Aug. 1882.
					Mohamad Hossain	1st Sept. ,,	31st Jan. 1883.
					Pashuput Sharan Sinha	1st Feb. 1883	9th Mar. ,,
					Mohamad Hossain	10th Mar. ,,	31st Mar. ,,
Mongpoo	4th	......	......	......	George A. Gammie	1st April 1882	31st Mar. ,,
Makhla	4th	J. Balantine, Esq.	1st April 1882	31st Mar. 1883	Kuarsing	1st April ,,	9th June 1882.
					Jagmohan	10th June ,,	11th July ,,
					Kuarsing	12th July ,,	31st Mar. 1883.
Diamond Island	3rd	......	......	......	T. N. Marsh	1st April ,,	31st Mar. ,,
Port Blair	3rd	Surgeon-Major J. Reid, M.B.	1st April 1882	31st Mar. 1883	J. T. Peters	1st April ,,	31st Mar. ,,
Nancowry	3rd	......	......	......	S. Thomas	1st April ,,	13th July 1882.
					Shaik Kabeeroddeen	14th July ,,	30th Dec. ,,
					Shaik Abdool Wahad	31st Dec. ,,	31st Mar. 1883.

APPENDIX F.

Extracts from the Report on the Administration of the Meteorological Department in Western India during the year 1882-83.

The work of the Meteorological Department in Western India during the past official year has been carried on much as usual, attention having been given mainly to securing uninterrupted records of trustworthy and comparable observations at the second and third class stations. A healthy ambition to do good work has been created amongst the observers by the grant, since April 1882, of good work allowances; and it seems likely that by this means the character of the observations will in many cases be improved. At those stations where soldiers were employed as observers, interruptions in the registers were constantly liable to occur, owing to the soldiers being summarily called away for military duty. To remove this liability, the soldiers have been replaced by civilians, who are subordinates of the Meteorological Department only. The storm-warning system has been carried on the same as in the previous year. Mr. F. Chambers, the permanent incumbent of the office of Meteorological Reporter for Western India, has been absent in England for ten months during the past year, and his place has been occupied during six weeks by Surgeon-Major W. Nolan, M.D., B.Sc., and during the remaining time by myself.

OBSERVATORIES.

The number of observatories remains the same as in last year, namely, four second class, eighteen third class, and one voluntary. Calicut has received a maximum and a minimum thermometer, and has thus, been placed on the same footing as the third class observatories. An application has been received from Mr. K. M. Joglekar, M.A., head-master of the Sirdar High School at Baroda, for permission to establish an observatory on the voluntary system at that station; and as the conditions of site and probable permanency appear favourable, the application is being forwarded. Besides the above observatories, there are over four hundred raingauge stations, which forward their returns regularly to this office. The list of observatories and the names of the Superintendents and the observers are given in the Appendix F II.

INSPECTION OF OBSERVATORIES.

During the cold season, (including the first week in April 1883,) I visited sixteen stations, namely, Surat, Rajkot, Deesa, Mount Abu, Neemuch, Indore, Malegaon, Kurrachee, Hyderabad (Sind), Jacobabad, Amraoti, Poona, Sholapur, Ratnagiri, Belgaum, and Goa.

Surat.—There are two observatories here, one at the camp, 3 miles out of the town, where the barometer, thermometers, and raingauge are situated; and one at the castle in the town, where the anemometer is fixed. At the camp, the instruments were in good order; but the enclosure for the grass thermometer had been covered over by wire netting in order to prevent damage to the instrument through exposure to night birds and beasts; this has since been removed. The thatch of the thermometer shed required repairing. At the castle, the observer was one who had been trained ten months previously by the former observer, and as seems to be common in such cases, his work was defective. I taught him the method of reading the instrument, and of telegraphing the wind velocity, and at the same time showed him how to clean the instrument; the dial plate had been polished up with bath-brick, but the working parts left full of dust and sand. The observer at the camp complained of the want of a sufficient allowance for a messenger to take the daily telegrams to the telegraph office, which is situated 4 miles from the observatory, and I think he might be allowed Rs. 4 a month for a peon. It seems likely that in the course of only a few years the two companies of Native Infantry stationed here may be withdrawn altogether; and if this should occur, it will then be necessary to make some other provision for carrying on the meteorological work; it might therefore be possible to remove the observatory nearer to the telegraph office. With this prospect in view, I examined the position of the telegraph office and also the civil hospital; but as these are in the heart of the town, whereas the camp is in the open country, the meteorological conditions of the two former sites are likely to be so different from what they are at the latter, and moreover so little representative of the country about, that I should be prepared to recommend the establishment of a permanent observer at the present site, rather than the removal of the observatory.

Rajkot.—The instruments here were all in good order, excepting the anemometer, the pipe of which had been cut down so that the box of the anemometer rested directly upon the wooden cross-piece to which it was fixed. This had been done because the observer found the dial plate too high to be conveniently read. A fresh piece of pipe has since been supplied, and theanemometer refixed at the standard heigth above its support. The observer here made the mistake of taking observations by Madras instead of local time. During the year 1881-82, there were two long interruptions in the work of the observatory at this station, and it was, therefore, considered desirable to inquire into the possibility of removing the instruments to the neighbourhood of the telegraph office and appointing the telegraph master meteorological observer. I therefore visited the telegraph office and found the telegraph master, Mr. W. G. Harvey, willing to undertake the work. There is open ground on the west side of the telegraph compound, which would be suitable for the thermometers, &c., and the anemometer could be fixed at the top of a wooden pillar on the roof of the telegraph office. The site here, however, is not quite so favourable as the present one, being somewhat more closed in; and as the present observer is doing his work well, and there is not much reason to suppose he will be suddenly called away, I have not considered it advisable to pursue the matter further.

Deesa.—The instruments here were in good order. The worm and worm-wheel of the direction vanes of the anemograph were clogged with stiff grease; this I recommended should be cleaned without stopping the instrument. The pin connecting the pendulum of the anemometer clock with the escapement was bent outwards, and rubbed against the clock case, so as to stop the clock if the case were put on. This I remedied, and also so bent the pin as to make the tick regular.

Mount Abu.—The instruments at this station were in good order, except that most of the thermometers required their graduation marks re-blackening; and that the outer bulb of the solar thermometer had a grey deposit inside. The barometers were hung in a dark corner of the office, These have subsequently, at my recommendation, been hung in the window recess, where there is a good light. Also the flagstaff and flag were too large, and seemed likely to interfere with the readings of the anemometer. These I recommended should be cut down in size and length. The observer, Bapalal Mehta, a writer in the military hospital, had been trained by the previous observer, corporal C. Barley. I examined him and found him to be painstaking and careful; but he made the mistake of taking the observations according to official instead of local time; and also in obtaining the number for accuracy in the daily telegrams had been in the habit of using the artificial barometric reading, as for instance 29·162 instead of the actual reading 26·162. These matters he has since attended to.

As there had been considerable interruptions in the records of this observatory, the advisability of removing the instruments to the neighbourhood of the telegraph office, and of appointing the telegraph master to be observer, had been considered; and I inspected the site of the telegraph office with this in view. It is not so suitable as the present site, being situated in a hollow and surrounded with trees. There is a rising piece of land at a short distance from the office just on the borders of and within the Resident's compound; and if no other site were available, this would have been the best in the neighbourhood. As however the present observer, Bapalal Mehta, is doing the work satisfactorily, and as he, not being a military man, is not likely to be removed from this station, it has not been necessary to take further steps in the matter.

Neemuch.—The instruments at this station were all in good condition, except the anemometer, which had been damaged by a fall during a high wind. The cups were bent out of shape. It has since been replaced by a new one, and has been recompared in Bombay, its factor now being 1·37 instead of 1·30 as formerly. The observer did not understand the use of the new eight-word telegraph code; this I explained to him, and his telegrams have since been made out more correctly. He also took observations by Madras time instead of local.

Indore.—The observer here, Trimbukrao, was not trained in Bombay, but by the former observer, Gunpat Singh. He is the store-keeper of the civil hospital. I examined him, and found him painstaking and his work fairly reliable; but in no case have I found men locally trained so sure in their work as those trained in Bombay. The anemometer, which is one of Robinson's five-wheeled instruments, is not well situated; it is fixed on the gable end of a building, on the same level as the ridge of the roof; and around this building there are trees, some of which are higher than the ridge of the roof. Moreover, there is a thick flagstaff rising up several feet above the anemometer and fixed close to it. It would be better if the anemometer were raised 8 or 10 feet above the ridge of the roof. But as it is probable that it has been fixed in this position for many years, I did not consider it advisable to make any alteration. The barometer also was badly placed, being hung from a projecting shelf, and having nothing but dark space behind it. I had sheets of white paper placed behind, in order to facilitate the reading. The other instruments were all in order, and the observer took the readings correctly by local time.

Malegaon.—The observer at this station, Anaji Pandurang, had been in Bombay some days for training, but had had to leave before he could get his certificate of competency. I examined him and found his work fairly accurate, but made his receiving a certificate of competency conditional upon the nature of his work during the next few months. He was, however, shortly ordered away and replaced by another man, Gopal Cuddum, whose work has not been uniformly satisfactory. The observer, Anaji Pandurang, took his observations by Madras time. The barometer was badly placed being hung from a screw fixed in a cupboard whose sides were slanting, and the barometer resting against the cupboard slanted with it. The thermometer graduation marks required re-blackening; and the thermometer shed admitted a little sunshine through the roof on the south side. I directed that the barometer should be hung vertically, and that the other matters should receive attention.

Kurrachee.—The instruments were all in good order. The military observer, private F. Bateman had been in the habit of counting the marks of the barometer vernier upwards from the bottom of the vernier, not from the lowest mark of the vernier. In most of the barometers the bottom of the vernier is intended to be counted as the lowest mark; this was the case in the barometer which the observer used during the course of his training in Bombay. But in the Kurrachee barometer there is a little extension of brass below the lowest graduation mark, in order to make that mark more distinct. This the observer had counted as an extra mark, so that his readings had been too high by the amount of one vernier graduation, that is by ·048 of an inch, and therefore from all his readings taken between 3rd January 1882 and 24th January 1883 this amount has been subtracted. After the latter date he read the barometer correctly.

It is under consideration to extend the building at the Napier Hospital, where the observatory is situated; and it may be necessary to remove the barometer and the thermometer shed. I therefore looked about for another possible site, and considered that in case it should be necessary to remove the instruments, the barometer might be placed inside the anemometer tower, and the thermometer erections placed about 200 feet to the west of the tower.

Hyderabad (*Sind*).—The instruments at the hospital were in good order, except that the dry and wet bulb thermometers had been screwed to the cross bar of the cage by means of iron screws which had become so rusted that it was impossible to remove them without risk of breaking the thermometers; this has since been remedied, the screws having been replaced by brass ones.

The anemometer is placed at the top of a tower, on the outer wall of the jail, about a mile from the hospital. The man who attended to it was not present, so that I could not examine the instrument nor explain the proper use of it to the observer, whose readings frequently appear doubtful.

Jacobabad.—I found 16° of spirit at the far end of the grass thermometer; but was unable to discover from what date this source of error had commenced. The present observer, Narayen Mane, formerly stationed at Bhuj, had taken charge only a short time before I visited the place. He said that the old observer, Karim Rajakhan, had been in the habit of reading the grass thermometer every morning without having placed it outside the previous evening; it remained in the office all night. The maximum thermometer slanted backwards so much that the detached portion of the column of mercury ran back instead of registering the maximum temperature. This I remedied by placing the thermometer horizontal, but it appears to have gone wrong again, and has had to be replaced by another one. The anemometer had not been cleaned for many months. I took it down, and had it thoroughly cleaned. The rest of the instruments were in order.

Amraoti.—I visited this station at the request of Dr. T. Hume, the Superintendent of the observatory, whose office it was intended to have removed into another building, thus rendering it desirable that the observatory also should be removed. I examined the proposed new site and found it suitable. It is about half a mile to the west of the present site, on open ground about 300 or 400 feet to the north of the Lunatic Asylum. This Asylum consists of a series of low buildings, not likely to affect the meteorological conditions at that distance. There is a low hill in a south-westerly direction from the proposed site, but I think it is not near enough to materially affect the readings of the instruments. I proposed that, in the new observatory, the thermometer shed should be made according to the standard pattern, and that the anemometer should be placed upon a tower about 30 feet high instead of on a short post as it is at present. The proposed site is so similar to the present one that it may not be necessary to continue double observations for a whole year; but this can be ascertained only after a few months' trial. The instruments at this observatory were all in order except the anemometer, which frequently registered a calm when there was a perceptible breeze blowing. This was owing to the friction pellet at the bottom of the verticle spindle having been lost. Another pellet has since been supplied.

Yerrowda (Poona).—The instruments at this observatory were in good order and do not call for special remark except the anemometer. It is one of Casella's self-registering instruments. The ribbon of paper stuck between the velocity rollers, so that it was impossible to pull the paper through without tearing it. This I found to be caused by the brasses of the bearings of rollers being too tightly screwed down. The gearing below the velocity chain did not work smoothly. This I found to be due to the length of the chain, which allowed the teeth of the improved roller to catch in the teeth of a wheel underneath. This was remedied by having the table on which the recording apparatus was fixed planed down ⅛th of an inch, and after this was done the instrument worked smoothly. It was also taken to pieces and thoroughly cleaned and oiled.

Sholapur.—Owing to the withdrawal of troops from this station, the regimental hospital is now deserted, and there is no longer work for a medical subordinate. It has therefore become necessary to make other arrangements for carrying on the observatory work. And I visited the place with the object of seeing what arrangements would be suitable and practicable. The present site is the best which could be obtained in the neighbourhood; but it requires the observer to be resident on the spot, or at least to spend a great part of his time there. The next best site is near the Government telegraph office, about half a mile to the south-east of the regimental hospital on slightly rising ground at the border of the maidan. The civil hospital is very unfavourably situated for observatory purposes. It has therefore been decided, with the concurrence of the telegraph authorities, to remove the observatory to the site of the telegraph office and appoint the telegraph master observer.

The present observer, who took over charge on the 26th December last, was not trained in Bombay, and as is generally the case in such instances, his work was defective. He appears to have seldom used the adjusting screw in reading the barometer, and the anemometer was very dirty, the glass face being so stuck with sand and stiff oil that it had to be broken to get it out. It is likely that before the barometer readings since the 26th December can be used for comparison with others, a correction for capacity will in some, if not all, instances have to be applied. The observer took the readings by what he called local time, but his clock was 30 minutes later than Madras time, so that the observations were taken by Bombay, not Sholapur, time, which is only about 18 minutes later than Madras.

Belgaum.—The instruments at this station were all in good order, except that the arrangement for lifting the pencils of the Robinson-Beckley anemograph worked very stiffly, so that when the lowering screw was turned to allow the pencils to fall, the pencils would not go down unless pressed with the hand. The effect of this was that the pencils did not always touch the paper, and the trace was consequently not continuous. I took the instrument to pieces, discovered the cause of the stiffness, and remedied it, so that the traces now are continuous. In putting the instrument together again, I did not notice that the pin for marking the time on the paper was fixed 35 minutes behind the pencils. Until therefore this can be re-adjusted, 35 minutes will have to be subtracted from the time shown by both the pencils.

As the anemometer tower is situated about 1¼ miles from the thermometer shed, much inconvenience is experienced, especially in rainy weather, in passing between the two places, and this inconvenience is felt more considerably by the new civilian observer, who, owing to his not being a military subordinate, is not allowed to occupy any of the buildings near the observatory office. It would be very desirable to have all the observatory buildings compact and together; and as the anemometer tower stands on a very favourable site, I have taken steps to see if it would be practicable to have an office, thermometer shed, and observer's quarters built near to the tower.

Ratnagiri.—I found everything in order here. The tower for the new Casella's self-recording anemometer had been finished, and the instrument fixed in it. I examined the instrument to see that it was in order, placed the direction arrow true, and explained to the observer the method of reading the records. The tower is situated on a very favourable site, on high and open ground near the reservoir of the water-works at some distance inland from the cliff.

Goa.—I had arranged to inspect the observatory at Karwar, and after leaving Belgaum embarked in a pattymar from Vingorla with that object. But adverse winds and calms obliged me after being on the sea for 29 hours to put in at Goa. Whilst waiting there for the return steamer, I inspected the meteorological observatory. It is under the charge of Mr. A. F. Martins, a Professor in an educational institution there. The anemometer was fixed on a lamp post in front of a large military building on the quay. The wet and dry bulb, maximum, dry minimum, and wet minimum thermometers were hung on the wall inside the office. The sun and grass radiation thermometers were not used owing to the want of a proper place for them. There were two raingauges; one hung on a lamp post out side a garden wall, and not sufficiently removed from trees; and the other placed on the ground inside the garden, the exact position of which I did not see. Mr. Martins, whom I have to thank for his kindness in showing me all the arrangements, said that he had tried to have a proper observatory building erected, such as had been suggested by Mr. F. Chambers; but the expense had been an insurmountable obstacle. I suggested that the anemometer should be fixed at the top of a post on the roof of the military building, and that the same arrangements for the exposure of the thermometers and raingauge should be adopted as throughout British India. I forwarded a copy of the Indian Meteorologist's Vade Mecum, Part I, to Mr. Martins, and at his request I submitted my suggestions officially in writing; he thought it would be possible to have the suggested arrangements sanctioned.

The correction to the Bombay standard for the barometer at Goa, as ascertained by six readings, none of which varied by more than $\frac{1}{500}$th of an inch, was +·017. There were two thermometers which had Kew certificates. They were as follows:—

No. 29560.	°	No. 29561.	°
32°	—0·1	32°	+0·1
42°	0·0	42°	+0·1
52°	0·0	52°	0·0
62°	—0·1	62°	—0·1
72°	0·0	72°	0·0
82°	—0·1	82°	—0·1
92°	—0·2	92°	—0·1

These thermometers were not employed in taking the ordinary meteorological observations.

INTERRUPTIONS IN THE RECORDS.

There have been only two cases of interruption during the year 1882-83. One was a break of 9 days at Bhuj owing to one observer having been ordered away on medical duty before the other, who had been sent down to Bombay for training, was ready to take over charge. The other was break at Zanzibar, owing to the observer, Shaik Adam, having been committed to jail on the 31st January. During nearly the whole period from the 1st February up to the end of March, Dr. Bartholomeux, the Superintendent of the observatory, very kindly took barometer and thermometer readings at 10 hours and 16 hours in order to prevent a complete break in the observations at this important station.

CHARACTER OF THE WORK OF THE OBSERVERS.

Table II which will be found in the Appendix[1] gives a list of the errors under different headings which have been discovered in the work of the observers at the different stations. And from these, the order of merit of the observers has been calculated, by assigning a maximum number of 200 marks to each one, and subtracting from that number the total of the mistakes each one has made in the year, or would have made during a year if his work had continued so long, and had remained of the same average character throughout. Calculating in this way the following is their order of merit :—

Name.	Number of merit.	REMARKS.
Hiralal	200	Recommended for good work allowance of Rs. 5; but time of service too short.
Damoder Bhide	200	Volunteer observatory. Not now in the Department.
Corporal W. Birch	196	Not now in the Department.
Bapalal Mehta	196	Recommended for good work allowance of Rs. 5; but time of service too short.
G. W. M. D'Aranjo	192	Volunteer observatory.
Ameenullákhán	191	Not now in the Department.
Solomon Samuel	190	Obtained good work allowance of Rs. 5 this year.
Corporal H. Farmer	190	Had a good work allowance of Rs. 10 last year. Not now in the Department.
Samuel Gregory	190	Had a good work allowance of Rs. 5 last year. Obtained one of Rs. 10 this year.
Mahadev Cuddum	188	Obtained good work allowance of Rs. 5 last year.
	average.	
Narayen Mane	187	Obtained good work allowance of Rs. 10 last year.
Surgeant T. Murphy	187	Not now in the Department.
Private F. Bateman	186	Ditto ditto.
V. E. Nazareth	186	
Mahesh Buxsing	185	
Ram Lal	184	Obtained good work allowance of Rs. 5 last year.
Yousiff David	184	Not now in the Department.
Anajee Pandurang	183	Ditto ditto.
Dhunjibhai Motabhai	181	Obtained good work allowance of Rs. 5 last year.
Private E. Killick	180	Not now in the Department.
Pandurang Krishnaji	165	

---

[1] Not Printed.

Name.	Number of merit.	Remarks.
Hospital Sergeant C. Barley	164	Not now in the Department.
Trimbakrao	162	
Enoch Shadrach	162	Not now in the Department.
Keshav Govind	156	Ditto ditto.
W. J. Neil	154	Ditto ditto.
Bukaram Pandurang	152	Obtained good work allowance of Rs. 5 last year.
Atmaram Bapuji	152	
T. Bachu	142	Obtained good work allowance of Rs. 5 last year.
Karim Rajakhan	60	Not now in the Department.
Gopal Cuddum	—144	His work has now much improved.

From this list it will be seen that the work is of a creditable character.

Two of the men have got the full 200 marks, and out of thirty-one men twenty have obtained over 180. The remarkably low number of Gopal Cuddum is due to the fact that, for some unexplained reason, his barometer readings from 17th December 1882 to 20th January 1883, and from 3rd to 28th February 1883, were wholly unreliable, and have had to be rejected. Karim Rajakhan has left the Department, and is not likely to be again appointed to do meteorological work. It is to be hoped that the observers will ascertain from Table II the nature of their individual defects, and endeavour in the coming year to remedy them.

TRAINING OF OBSERVERS.

There have been five second class and six third class observers trained in the Bombay Office during the year under report.

The following is the list:—

Second Class . .
- Private E. Killick obtained his certificate on the 5th May 1882 and was sent to Deesa.
- Keshav Visnu Apte do. do. 6th March 1883 do. Belgaum.
- Ram Krisna Keshav do. do. 20th March 1883 do. Deesa.
- Narayan Sakaram Kelker do. do. do. do. Poona.
- Narayan Vinayek Raje was in training on 31st March 1883, and to be sent to Kurrachee.

Third Class ...
- Samuel Samson obtained his certificate on the 29th August 1882.
- Mahesh Buxsing do. do. 3rd October 1882, and was sent to Bhuj.
- Martand Ram Krishna do. do. 6th January 1883.
- Shaik Abdur Rahman do. do. 26th March 1883, and was sent to Zanzibar.
- Shewrattan Baijnath } were in training for several days but left before obtaining their certificates.
- Solomon Ezekiel }

Besides the above Bapalal Mehta was trained at Mount Abu by Corporal C. Barley.

APPOINTMENT OF CIVILIAN OBSERVERS AT SECOND CLASS OBSERVATORIES.

At the suggestion of Mr. Blanford, and with the concurrence of Dr. Nolan, the Government of India have during the past year sanctioned the replacement of soldier observers at Kurrachee, Deesa, Poona, and Belgaum by civilians. This was done in order to do away with the frequent and serious breaks, which were apt to occur in the registers of these stations, owing to the soldiers being suddenly called away for military duty. At the same time, the employment of civilians is more economical, as this Department was always debited with the soldiers' military pay as well as their meteorological allowance. The sanctioned expenditure of the four observatories during 1882-83 was, exclusive of special allowances, as follows :—

Poona	Rs.	798
Belgaum	„	700
Kurrachee	„	725
Deesa	„	831
Total	Rs.	3,054

According to the sanctioned new arrangement the cost will be as follows :—

Poona, at the rate of 1 observer, at	Rs.	30		
1 assistant, at	„	10		
Contingencies	„	2		
Total	Rs.	42	Rs.	504
Belgaum, do. do.			„	504
Kurrachee, do. do.			„	504
Deesa, do. do.			„	504
Total			„	2,016

Thus, if the cost of pensions be not taken into account, there will be an annual saving of Rs. 1,038.

In addition to the above statement of cost, a payment of Rs. 20 per mensem for two months, if necessary, was sanctioned for each civilian observer during the period of his training. The names of the four men selected, and the dates on which they received their certificates of competency, are given in the above list of observers in training. Two of them, Keshav Vishnu and Narayan Vinayek Raje, hold matriculation certificates from the Bombay University; and the other two, Ramkrishna Keshav and Narayan Sakharam Kelker, had been temporarily employed as computers in the Colaba observatory; and the latter had of his own accord while in the observatory undergone a course of training as third class observer. Narayan Vinayek Raje was not ready to receive his certificate by the 31st March 1883, but he obtained it about a fortnight later, and proceeded to Kurrachee.

The change of observers at these four stations, has not been a cause, of itself, sufficient in any case, to make it necessary to change the sites of the observatories; but as reported above, under the heading of "Inspection of Observatories" there are other causes which, when combined with this one, may make it necessary to remove their positions at Kurrachee and Belgaum. The soldier observers were always allowed free quarters for residence, but these are not guaranteed to the civilian observers. In Poona, where there are many spare rooms at the out-buildings of the Yerrowda Jail, the observer is allowed to occupy one. At Belgaum, although there are many vacant rooms in the European soldiers' married quarters, the observer is not allowed to occupy one, owing to his being a civilian; and as there are no non-military quarters within a reasonable distance of the observatory at a less rent than Rs. 10, the observer is obliged to live at a considerable distance. At Deesa the observer is allowed to occupy a room in the European soldiers' married quarters, but has to pay Rs. 3 rent for it. At Kurrachee the matter of the observer's residence is not settled. There is no doubt that it would make the observers more satisfied and tend to the effectiveness of their work if the Department would in all cases guarantee them free quarters near the observatories.

Another difficulty has arisen, namely, with regard to the carrying of messages to the telegraph and post offices, which are in every case situated at some distance from the observatories, and also with regard to cleaning and tidying the offices. It was customary for the soldier observers to engage men at their own expense to do this; and three out of the four have, since their dismissal, asked that they may be refunded the money so expended. I have tried to meet the case with regard to the civilian observers by instructing them to obtain men as assistant observers whose education and caste shall not be so high as to prevent them from doing this work, but who at the same time shall be intelligent enough and trustworthy enough to make them capable of assisting the head observers in taking their hourly observations. But whether or not this arrangement will prove practicable cannot at present be decided.

ALTERATIONS IN THE FACTORS OF INSTRUMENTS.

During my inspecting tours I compared the barometers and thermometers of most of the stations with the travelling standards; the results are given below:—

Stations.	Barometer.	Dry bulb thermometer.	Dry maximum thermometer.	Wet bulb thermometer.	Wet minimum thermometer.	Dry minimum thermometer.	Grass minimum thermometer.
	Inch.	°	°	°	°	°	°
Surat . . .	Fallen ·001	Risen 0·2	Fallen 0·1	Risen 0·2	0·0	0·0	Risen 0·3
Rajkot . . .	Risen ·008	Fallen 0·1	„ 0·3	0·0	Risen 0·8	Fallen 0·1	Fallen 0·5
Deesa . . .	„ ·002	„ 0·2	„ 0·7	Risen 0·2	„ 1·0	Risen 0·1	„ 0·2
Mount Abu . .	No. 48. „ ·083	0·0	Risen 0·1	Fallen 0·1	0·0	Fallen 0·1	0·0
Mount Abu . .	No. 710. „ ·005	......	......	......	......	......	......
Neemuch . . .	„ ·004	Fallen 0·1	Fallen 0·1	Fallen 0·1	Risen 0·5	Risen 1·0	......
Indore . . .	„ ·006	„ 0·1	„ 0·9	0·0	„ 0·3	Fallen 0·1	......
Malegaon . . .	Fallen ·016	Risen 0·1	0·0	0·0	0·0	„ 0·1	Fallen 0·3
Kurrachee . .	Risen ·006	Fallen 0·2	Fallen 0·4	Fallen 0·2	Fallen 0·4	Risen 0·2	„ 0·2
Hyderabad . .	„ ·004	......	0·0	......	„ 0·1	Fallen 0·8	0·0
Jacobabad . .	„ ·002	Fallen 0·1	Fallen 0·1	Risen 0·2	Risen 0·8	„ 0·1	Risen 0·2
Poona . . .	......	„ 0·2	„ 0·2	0·0	Fallen 0·6	„ 0·1	Fallen 0·3
Ratnagiri . . .	Risen ·004	„ 0·1	„ 0·1	Fallen 0·5	Risen 0·7	Risen 0·3	Risen 0·3
Amraoti . . .	......	......	„ 0·1	......	Fallen 0·1	„ 0·3	„ 0·4
Belgaum . . .	Risen ·015	Fallen 0·2	0·0	Fallen 0·1	......	Fallen 0·5	Fallen 0·7

The greatest change is shown in the new barometer at Mount Abu. It had been surmised from the comparison for storm-warning purposes of the barometric readings of this station with those of other stations that there was some considerable change in the instrument. Whether this change is due to the loss of mercury out of the cistern during transit of the instrument or to a difference of index error for the lower part of the scale, I could not ascertain. The barometer at Bickaneer also, judging from the abnormal curves prepared for guidance in the storm-warning work, appears to have been abnormally low, and will probably require to be replaced by another one.

COMPARISON AND ISSUE OF INSTRUMENTS.

The following list[1] shows the instruments which have been issued to the observatories during the year.

Of the above the barometers, anemometers, and thermometers were all compared previous to their being issued. It is very noticeable how much more the grass radiation thermometers are subject to damage than any of the other instruments. This is owing to their being exposed to the attacks of dogs and jackals. In many cases it has been found useful to protect them by putting up around the enclosure in which the radiation thermometers are exposed a railing about 2 feet high covered with wire netting.

---

[1] Here omitted, being incorporated in the general list, Appendix I.

LIBRARY.

Table III of the Appendix[1] gives the list of books and pamphlets added to the library during the past year.

* * * * * *

STORM-WARNING SERVICE.

This service has been conducted on the same footing as last year; except that, since the 1st September 1882, the new eight-word code has been used instead of the former code which had only six words. By the use of these two extra words, it is now possible to telegraph the readings of the dry maximum and dry minimum thermometers and also the wind velocity and general weather remarks at the time of taking the observation. Another addition to the sources of information has been the daily weather telegrams received from the Meteorological Reporter to the Government of India. These telegrams have been on two or three occasions useful in confirming what had already been discovered from the reports prepared in the Bombay office.

Morning telegrams giving the observations at 10 hours have been received regularly from the following stations:—

Kurrachee.
Surat.
Ratnagiri.
Karwar.
Mangalore.
Calicut.
Cochin.
Negapatam.
Madras.
Masulipatam.

And also the morning observations of Bombay have been received as usual. Besides these special morning or afternoon observations have been called for and received as follows.[2]

Telegrams of a cautionary or re-assuring nature or instructing that the storm-signals should be hoisted were forwarded as follows:—

Names of Ports.	Dates on which telegrams were sent to hoist storm-signals.	Dates on which cautionary telegrams were sent.	Dates on which re-assuring telegrams were sent.
Kurrachee	13th and 23rd July 1882	6th and 12th August and 11th and 13th September 1882, 25th January and 28th February 1883.	8th August and 11th September 1882.
Bhavnagar	13th July 1882	11th September 1882, and 25th January 1883.	11th September 1882.
Daman	1st June and 13th July 1882	Ditto ditto	3rd June and 11th September 1882.
Bombay	1st June 1882	14th May 1882	3rd September 1882.
Ratnagiri	11th „ „	24th November 1882	27th November 1882.
Goa	11th „ „	Ditto	Ditto.
Vengurla	11th „ „	...	...
Karwar	11th „ „	24th November 1882	27th November 1882.
Kumta	11th „ „	Ditto	Ditto.

During my absence from Bombay on inspecting tours, Mr. C. Chambers, F.R.S., the Superintendent of the Government Observatory, Bombay, examined the daily weather charts and reports, and advised the office as to the calling in of special telegrams and the issue of storm-warnings.

Much inconvenience has been felt by myself and the storm-warning clerks, owing to the want of accommodation for residence. During stormy weather it is frequently necessary that night work should be done; and reference has then to be made to the Meteorological Reporter during the night, so that it is necessary that he should live near the office; and for the same reason it is very desirable that the weather clerks also should live near to the office, instead of more than 3 miles away, as is the case at present.

---

[1] Not printed.

[2] This list omitted.

During the year, I have forwarded to Mr. Blanford a special report on the working of the storm-warning system in Bombay, in which I have stated distinctly what I consider to be the chief disadvantages under which it has to be worked; it is not therefore necessary to detail them here.

* * * * * *

OFFICE ESTABLISHMENT.

Mr. Frederic Chambers, the permanent incumbent of the office, applied for one year's furlough under rule 131, but owing to delays in obtaining it was obliged to apply for leave on medical certificate under rule 127, and gave over charge of the office on the 6th June 1882 to Surgeon-Major W. Nolan, M.D., B.Sc., who on the 17th July 1882 handed over the office to me in accordance with Government of India's letter Nos. $\frac{49\text{ Met}}{2\text{-}18}$ dated the 23rd June 1882, to the Government of Bombay.

The office establishment at the end of the year was as follows:—

Name.	Monthly pay.
FOR LAND METEOROLOGY.	Rs.
Ganesh Sadashiv	54
Vajeram Ichharam	39
Mahadev Ramchandra	38
Krishnaji Ramchandra	30
Ramchandra Sadashiv	30
FOR STORM-WARNING SERVICE.	
Ramchandra Govind	30
Anant Vishvamber	30

There is also one menial whose pay is Rs. 10 per month. Mr. Mahadev Ramchandra took privilege leave for fifty days, from the 4th April 1883 to the 23rd May 1883.

The two weather clerks, in accordance with Mr. Chambers' instructions, attended the early morning classes at the Sir Jamsetji Jijibhai School of Art, and went through the preliminary and 2nd grade examinations with very creditable results in the case of Mr. Ramchandra Govind and only moderate results in the case of Mr. Anant Vishvamber.

I have always found the various members of the office staff efficient in their duty, and their thorough knowledge of the routine work of the Department has been of great assistance to me during my term of office.

WORK OF THE OFFICE.

The work of the office has during the year under report consisted of the usual receipt, correction, computation and tabulation of the results from the third class observatories, and the correction and tabulation of those from the second class observatories; and also of the work connected with the storm-warning system. The complete monthly returns have been forwarded as usual to the Meteorological Reporter to the Government of India, and the monthly abstracts published in the *Bombay Government Gazette*.

A sketch of the meteorology of the Bombay Presidency, in 1881, was prepared by me shortly after having taken over charge of the office. In this sketch I made a comparison between series of barometric abnormal observations of Zanzibar, Belgaum, and Bombay, and briefly discussed the possibility of the use of the Zanzibar observations for the purpose of predicting the nature of the coming seasons in Western India. This matter I followed up subsequently in a paper entitled "A contribution to the study of the Transmission Eastwards round the globe of Barometric Abnormal Variations." A copy of this paper was forwarded to the Meteorological Reporter to the Government of India. I had intended to have followed up this subject still further, but other work has prevented me.

I have also worked out a special mechanical arrangement which when coupled with the ordinary cups of the Robinson anemometer will give traces of the longitudinal and latitudinal wind components.

The storm data collected by Mr. Chambers from a number of ship logs kindly furnished by Captain Morland, the Port Officer of Bombay, have been tabulated in a form convenient for purposes of investigation, and it was my intention to have conducted the investigation. I had decided upon what I thought would be a useful method of work; but I have not been able owing to other engagements to follow up the matter.

In conclusion, I would state that many of the medical officers in charge of the observatories have taken special interest in the meteorological work, and the thanks of the Department are due to them for their trouble.

A. N. PEARSON,
Acting Meteorological Reporter for Western India.

METEOROLOGICAL OFFICE, BOMBAY;
Dated the 6th June 1883.

APPENDIX F. II.

Names of the Superintendents and of the Observers at the Meteorological Observatories in Western India during the year 1882-83.

Observatory.	Class.	Superintendent.	Date.		Observer.	Date.		Remarks.
			From	To		From	To	
Kurrachee	Second	Surgeon-Major J. Paxton	1st April 1882	31st March 1883	Private F. Bateman	1st April 1882	31st March 1883.	
Deesa	Do.	Brigade-Surgeon C. MacDowell	1st April ,,	11th Feb. ,,	Corporal W. Birch	1st April ,,	20th June 1882.	
		Surgeon-Major J. Lyons	12th Feb. 1883	31st March ,,	Private E. Killick	21st June ,,	26th March 1883.	
					Ramkrishna Keshav	27th March 1883	31st March ,,	
Yerrowda (Poona)	Do.	Surgeon J. P. Greany	1st April 1882	30th Nov. 1882	Sergeant T. Murphy	1st April 1882	31st March ,,	
		Surgeon-Major S. M. Solomon	1st Decr. ,,	31st March 1883	... ...	......	......	
Belgaum	Do.	Brigade-Surgeon S. A. Lithgow	1st April ,,	4th April 1882	Lance Corporal H. Farmer	1st April 1882	15th March 1883.	
		Surgeon Harmon	5th April ,,	9th April ,,	Keshav Vishnu	16th March 1883	31st March ,,	
		Surgeon-Major F. W. Hodder	10th April ,,	28th Nov. ,,	... ...	......	......	
		Do. R. P. Ferguson	29th Nov. ,,	31st March 1883	... ...	......	......	
Jacobabad	Third	Surgeon M. L. Bartholomeux	1st April ,,	11th May 1882	Karim Rajakhan	1st April 1882	21st Oct. 1882.	
		Do. J. McCloghry	12th May ,,	31st March 1883	Narayen Mane	22nd Oct. ,,	31st March 1883.	
Bickaneer	Do.	No Superintendent	......	......	Ram Lal	1st April ,,	31st March ,,	
Hyderabad (Sind)	Do.	Surgeon-Major C. S. Close	1st April 1882	3rd Oct. 1882	Yousiff David	1st April ,,	16th May 1882.	
		Do. H. M. Macbeth	4th Oct. ,,	31st March 1883	W. J. Neil	17th May ,,	31st Oct. ,,	
					V. E. Nazareth	1st Nov. ,,	31st March 1883.	
Bhuj	Do.	Surgeon W. A. Barren	1st April 1882	31st March ,,	Narayen Mane	1st April ,,	1st Oct. 1882	
					No Observer	2nd Oct. ,,	10th Oct. ,,	
					Mahesh Buxsing	11th Oct. ,,	31st March 1883.	
Mount Abu	Do.	Surgeon-Major C. W. Watling	1st April ,,	18th Sept. 1882	Hospital Sergeant C. Barley	1st April ,,	30th Sept. 1882.	
		Surgeon A. Hewett	19th Sept. ,,	9th Decr. ,,	Bapalal Mehta	1st Oct. ,,	31st March 1883.	
		Surgeon-Major C. White	10th Decr. ,,	31st March 1883	... ...	......	......	
Neemuch	Do.	Do. J. McD. O'Farrell	1st April ,,	15th Jany. ,,	T. Bachu	1st April 1882	7th April 1882.	
		Do. J. R. Croker	16th Jany. 1883	31st March ,,	S. Samson	8th April ,,	19th April ,,	
					T. Bachu	20th April ,,	31st March 1883.	

Names of the Superintendents and of the Observers at the Meteorological Observatories in Western India during the year 1882-83.—contd.

Observatory.	Class.	Superintendents.	Date.		Observers.	Date		Remarks.
			From	To		From	To	
Indore	Third	Surgeon-Major D. F. Keegan	1st April 1882	10th May 1882	Trimbukrao	1st April 1882	31st Mar. 1883.	
		Do. R. Caldecott	11th May ,,	9th August ,,	... ...	......	......	
		Do. D. F. Keegan	10th August ,,	31st March 1883	... ...	......	......	
Rajkot	Do.	Surgeon G. H. Bull	1st April ,,	15th Oct. 1882	Solomo Samuel	1st April 1882	31st Mar. 1883.	
		Surgeon-Major H. R. L. MacDougall	16th Oct. ,,	16th Nov. ,,	... ...	......	......	
		Surgeon D. A. Gomes	17th Nov. ,,	28th Jany. 1883	... ...	......	......	
		No Superintendent	29th Jany. 1883	3rd Feb. ,,	... ...	......	......	
		Surgeon M. B. H. Braganza	4th Feb. ,,	22nd March ,,	... ...	......	......	
		No Superintendent	23rd March ,,	28th March ,,	... ...	......	......	
		Surgeon-Major S. B. Holiday	29th March ,,	31st March ,,	... ...	......	......	
Surat	Do.	Surgeon F. Jones	1st April 1882	4th May 1882	Dhunjibhai Motabhai	1st April 1882	31st Mar. 1883.	
		Do. B. N. Koyaji	5th May ,,	6th Oct. ,,				
		No Superintendent	7th Oct. ,,	16th Oct. ,,				
		Surgeon-Major J. Robb	17th Oct. ,,	31st Mar. 1883				
Akola	Do.	Surgeon J. J. Moran	1st April ,,	31st Mar. ,,	Samuel Gregory	1st April 1882	31st Mar. 1883	
Amraoti	Do.	Do. T. Hume	1st April ,,	31st Mar. ,,	Enoch Shadroch	1st April ,,	13th May 1882	
					Bukaram Pandurang	14th May 1882	9th Nov. ,,	
					Mahomed Samsudin	10th Nov. ,,	19th Nov. ,,	
					Bukaram Pandurang	20th Nov. ,,	27th Mar. 1883	
					Mahomed Samsudin	28th Mar. 1883	31st Mar. ,,	
Chikalda	Do.	Do. C. Mallins	1st April 1882	22nd June 1882	Ameenula Khan	1st April 1882	31st Oct. 1882	
		Do. D. F. Dymott	23rd June ,,	29th Dec. ,,	Hiralal	1st Nov. ,,	31st Mar. 1883	
		Do. C. L. Swaine	30th Dec. ,,	31st Mar. 1883				
Buldana	Do.	Do. D. Callaghan	1st April ,,	31st Mar. ,,	Pandurang Krishnaji	1st April ,,	31st Mar. ,,	
Malegaon	Do.	Do. W. A. Corkery	1st April ,,	30th Aug. 1882	Gopal Cuddum	1st April ,,	1st Aug. 1882	
		Do. A. S. Faulkner	31st Aug. ,,	17th Mar. 1883	Anaji Pendurang	2nd Aug. ,,	19th Nov. ,,	

		Do. P. J. Damania	18th Mar. 1883	31st Mar. ,,	Gopal Cuddum	20th Nov. ,,	12th Jan. 1883
					Atmaram Laliaji	13th Jan. 1883	22nd Jan. ,,
					Gopal Cuddum	23rd Jan. ,,	31st Mar. ,,
Sholápur	Do.	Do. H. B. Briggs	1st April 1882	22nd Mar. ,,	Keshav Govind	1st April 1882	25th Dec. 1882
		Apothecary W. R. Scorgie	23rd Mar. 1883	31st Mar. ,,	Atmaram Bapuji	26th Dec. ,,	31st Mar. 1883
Ratnagiri	Do.	Surgeon-Major M. M. Mackenzie	1st April 1882	25th May 1882	Mahadev Cuddum	1st April ,,	26th Mar. ,,
		Surgeon H. McCalman	26th May ,,	31st Mar. 1883	Somji Gharoji	27th Mar. 1883	30th Mar. ,,
					Mahadev Cuddum	31st Mar. ,,	31st Mar. ,,
Zanzibar	Do.	Surgeon-Major J. Robb	1st April 1882.	19th Aug. 1882	Shaik Adam	1st April 1882	31st Jan. ,,
		Surgeon M. L. Bartholomeux	20th Aug. 1882	31st Mar. 1883	Surgeon M. L. Bartholomeux	1st Feb. 1883	31st Mar. ,,
Karwar	Voluntary	R. G. C. Westbrook, Esq., Port Officer	1st April ,,	31st Mar. ,,	Damoder Bhidi	1st April 1882	30th April 1882
					G. W. M. D'Aranjo	1st May ,,	30th June ,,
					Damoder Bhidi	1st July ,,	30th Sep. ,,
					G. W. M. D'Aranjo	1st Oct. ,,	31st Mar. 1883
Calicut	Storm-warning Service.	Henry Richardson, Esq., Port Officer	1st April 1882	31st Mar. 1883	F. D. Rozario	1st April 1882	12th Oct. 1882
					Aroomoogum Modelliar	13th Oct. ,,	19th Oct. ,,
					F. D. Rozario	20th Oct. ,,	5th Mar. 1883
					Aroomoogum Modelliar	6th Mar. 1883	7th Mar. ,,
					F. D. Rozario	8th Mar. ,,	31st Mar. ,,

APPENDIX G.

Return showing the names of Superintendents aad Observers of the Observatories in British Burma for the year 1882-83.

Name of station.	Designation of officer.	Name and rank of officer.	Term of service.
Rangoon	Superintendent	Hugh Johnstone, Surgeon-Major	From 1st April 1882 till 31st March 1883.
	Observer	A. Sarfas	„ 1st April 1882 till 31st July 1882.
	Ditto	G. E. Wales	„ 1st August 1882 till 31st March 1883.
	Assistant Observer	Moung Loo Yin	„ 1st April 1882 till 31st December 1882.
	Ditto	Moung Meh Uyo	„ 1st January 1883 till 31st March 1883.
Bassein	Superintendent	S. H. Dantra, Surgeon, Bengal Medical Department.	Throughout the year.
	Observers	A. Soon	From 1st April 1882 to 31st January 1883.
		Chand Khan	„ 1st to 13th February 1883.
		Moung Hpay	„ 14th February to 31st March 1883.
Thyetmio	Superintendent	Surgeon P. W. Dalzell	„ 1st April 1882 to 26th July 1882.
	Ditto	Surgeon E. P. Frenchman	„ 27th July 1882 to 31st March 1883.
	Observer	2nd Class Hospital Assistant Alla Deen.	„ 1st April 1882 to 31st March 1883.
Moulmein	Superintendent	Surgeon-Major W. F. de Fabeck, M.D., Civil Surgeon.	Throughout the year.
	Observer	2nd Class Hospital Assistant F. St. Hilbert.	
Mergui	Superintendent	Asstistant Surgeon Omerto Lall Moonshi.	From 1st April 1882 to 2nd November 1882.
	Ditto	Hospital Assistant Rajib Ally	„ 3rd November 1882 to 31st March 1883.
	Observer	Mahomed Cassim	„ 1st April 1882 to 22nd March 1883.
	Ditto	Moosajee	„ 23rd March 1883 to 31st March 1883.
Tounghoo	Superintendent	Surgeon R. Pemberton	„ 1st April 1882 to 6th March 1883.
	Ditto	Ditto Maurice Smith	„ 7th March 1883 to 31st March 1883.
	Observer	3rd Class Hospital Assistant V. Chinasawmy Pillai.	„ 1st April 1882 to 6th March 1883.
	Ditto	1st Class Hospital Assistant M. Banboo, No. 874.	„ 7th March 1883 to 31st March 1883.

RANGOON;
The 29th May 1883.

D. SINCLAIR, M. B.,
Offg. Sanitary Commissioner,
British Burma.

APPENDIX H.

Return of the Stock and Issue of Instruments for the year 1882-83.

Instruments.	In Store on 1st April 1882.	Received 1882-83.	Issued 1882-83.
Van Rysselberghe's meteorograph	1	...	...
Barometers, observatory, Fortin's principle	12	3	8
Do. do. Kew principle	3	3	4
Do. mountain portable tripod (Adie)	22	5	6
Do. Marine Kew principle	26	...	4
Do. Newman's large standard	2	...	...
Do. do. small standard	4	...	...
Do. Negretti and Zambra (various)	14	4	7
Aneroids	19	...	1
Thermometers standard with attached scales	21	2	3
Do. without attached scales	1	...	...
Do. for hygrometers (Kew pattern)	93	8	22
Do. maximum for shade	132	9	16
Do. minimum do.	65	15	26
Do. do. radiation	12	53	33
Do. solar in Vacuo	47	5	16
Ponillet's pyrheliometer	1	...	...
Stewart's actinometers	1	1	2
Spare thermometers for do.	...	...	2
Hodgkinson's actinometers	2	...	...
Herschell's do.	1	...	...
Regnault's hygrometers	3	...	...
Daniell's do.	10	...	...
Halleur's do.	5	...	...
Boiling point thermometers	6	...	...
Pocket spectrescopes (Browning's)	2	...	...
Wind vanes	20	2	4
Anemometers	11	21	5
Anemographs (Beckley's)	...	3	1
Raingauges (Symon's and Glaisher's)	21	6	20
Measure glasses for do.	1	27	9
Reading lenses	5	3	5
Sun thermometer stands	24	1	4
Radiation pads	3	10	10

Return of the Stock and Issue of Instruments for the year 1882-83—(continued.)

Instruments.	In store on 1st April 1882.	Received, 1882-83.	Issued, 1882-83.
Thermometer cages	2	8	6
Do. for ships	7	12	4
Prismatic compass	1	...	...
Sand glasses (3 minutes)	29	6	30
Chain for Casella's anemograph	15 ft.	...	15 ft.
Sunshine recorder	1	...	...
Bulls' eye lantern	1	...	...
Salinometers	40	...	4
Common thermometers, brass scales	33	...	5
Clocks	3	4	5
Sling thermometers	...	10	...
Six's thermometers	...	2	2
Maximum thermometers	2	...	...
Mathematical instruments, drawing box	...	1	1
Glass disk for Nephescope	...	1	1
Pointer for do.	...	1	1
Spirit level	1	...	...
Hick's barograph	1	...	...
Thermograph with Negretti's and Zambra's sets of recording thermometers	1	...	...

APPENDIX I.

Return of the Instruments issued to each Observatory in 1882-83.

Provinces.	Stations.	Barometer.	Hygrometer.		Dry maximum thermometer.	Minimum thermometer.		Radiation thermometer.		Anemometer.	Wind Vane.	Rain-gauge.	Measure-glass.	Lens.	Clock.	Sundial.	Sand glass.	Sunshine Recorder.	Pad for glass radiation thermometer.	Cage.	Stand for sun thermometer.	Salinometer.	Common thermometer.	Standard thermometer.	Remarks.
			Dry.	Wet.		Dry.	Wet.	Solar.	Grass.																
Africa.	Zanzibar	...	...	...	...	...	...	...	...	...	...	...	...	...	1*	...	...	...	...	...	...	...	...	...	* In lieu of one out of order.
Cashmere.	Leh†	2	2	1	1	1	...	1	1	1	...	1	1	...	...	1	...	...	1	2	1	...	...	...	† Also Six's thermometers.
Punjab.	Mooltan	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	
	Dera Ismail Khan	1	...	...	...	...	...	...	1	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	
	Peshawar	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Murree	1	...	...	1	...	...	...	1	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	
	Rawalpindi	...	...	...	...	...	...	...	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	

Return of the Instruments issued to each Observatory in 1882-83—(continued.)

Provinces.	Stations.	Barometer.	Hygrometer.		Dry maximum thermometer.	Minimum thermometer.		Radiation thermometer.		Anemometer.	Wind Vane.	Rain-gauge.	Measure-glass.	Lens.	Clock.	Sundial.	Sand glass.	Sunshine Recorder.	Pad for glass radiation thermometer.	Cage.	Stand for sun thermometer.	Salinometer.	Common thermometer.	Standard thermometer.	Remarks.
			Dry.	Wet.		Dry.	Wet.	Solar.	Grass.																
Punjab—*contd.*	Sialkot	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Lahore	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Delhi	...	...	...	...	...	...	...	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	
N.-W. P. and Oudh.	Pauri	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	
	Roorkee	1	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Ranikhet	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	
	Meerut	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Agra	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Lucknow	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Gorakhpur	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Allahabad. Old observatory	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1	1	1	...	...	...	...	...	
	Allahabad. New ditto	...	1	1	2	1	1	1	1	...	...	1	...	...	...	...	...	...	1	1	1	...	...	...	Original furniture.
	Benares	...	...	...	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Assam.	Sibsagar	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Dhubri	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Tura	...	1	1	1	1	...	...	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	Original furniture.
Bengal.	Darjeeling (St. Paul's School)	2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	* Original furniture. † Old Instrument returned for verification.
	Durbhanga	...	...	...	...	...	...	...	...	1*	...	...	...	...	1	...	...	...	...	...	...	...	...	...	* To replace old one.
	Patna	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2*	...	...	...	...	...	...	...	* One broken in transit.
	Gya	1*	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	* For comparison.
	Hazaribagh	...	1*	1*	1*	1*	2*	...	1†	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	* Old Instrument returned for verification. † To replace old Instrument.
	Berhampore	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Dacca	...	...	...	...	1	...	...	...	1*	...	...	...	...	...	...	1	...	...	...	...	...	...	...	* To replace old one.
	Chittagong	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Saugor Island	...	...	...	...	...	...	...	1	1*	...	...	...	...	1	...	1	...	...	...	...	...	...	...	* To replace old one.
	Cuttack	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	False Point	2*	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	* Old Instrument returned for verification. † For comparison.
Central Provinces.	Sambalpur	...	1	1	1	1	1	1	1	...	...	1	1	...	...	...	...	...	1	1	1	...	...	...	Original furniture of duplicate observatory.
	Raipur	2	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...		...	

Return of the Instruments issued to each Observatory in 1882-83—(continued.)

Provinces.	Stations.	Barometer.	Hygrometer.		Dry maximum thermometer.	Minimum thermometer.		Radiation thermometer.		Anemometer.	Wind Vane.	Rain-gauge.	Measure-glass.	Lens.	Clock.	Sundial.	Sand glass.	Sunshine Recorder.	Pad for glass radiation thermometer.	Cage.	Stand for sun thermometer.	Salinometer.	Common thermometer.	Standard thermometer.	Remarks.
			Dry.	Wet.		Dry.	Wet.	Solar.	Grass.																
Central Provinces—*contd.*	Nagpur	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Seoni	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Jubbulpore	...	...	...	...	...	...	1	...	...	1	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Pachmarhi	...	...	...	...	...	...	...	...	1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	* Anemograph, Beckley's.
	Hoshangabad	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Chanda	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Berars.	Chikalda	...	...	...	...	1*	...	...	1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	* In lieu of one out of order.
	Buldana	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2*	...	...	...	...	...	* Ditto.
	Akola	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2*	..	...	...	...	...	* Ditto.
	Amraoti	1‡	...	...	...	...	...	...	1†	1*	...	...	...	...	1*	...	...	...	1*	...	...	...	...	...	* Ditto. † Do. broken. ‡ Exchanged.
Central India.	Neemuch	...	...	...	...	...	...	...	2†	...	...	...	...	...	...	...	...	...	2*	...	...	...	...	...	* In lieu of one out of order. † Do. broken.
	Nowgong	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Sutna	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Indore	...	...	...	...	...	...	...	1†	...	...	...	...	...	...	...	...	...	1*	...	...	...	...	...	* Do. out of order. † In lieu of one broken.
Rajputana.	Bickaneer	...	...	...	...	...	...	...	1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	* Do. out of order.
	Sambhar	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Mount Abu	...	...	...	...	...	...	1†	2†	...	...	...	1†	...	1*	...	...	...	1*	...	...	...	...	...	* Ditto. † Do. broken.
	Ajmere	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Bombay.	Jacobabad	...	...	...	...	...	...	...	...	...	...	...	...	...	1	.	...	...	...	...	...	...	...	...	In lieu of one out of order.
	Hyderabad	..	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Ditto.
	Kurrachee	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	..	Ditto.
	Bhuj	...	...	...	1†	...	...	...	1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	* Ditto. † Do. broken.
	Rajkot	...	...	...	...	...	...	...	...	1	...	...	...	...	1	...	...	...	1	...	...	...	...	...	Do. out of order.
	Deesa	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Do. broken.
	Surat	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Ditto.
	Poona	...	...	...	...	...	...	1*	1*	...	...	...	1*	...	...	...	...	...	2†	...	...	...	...	...	* Ditto. † Do. out of order.
	Ratnagiri	...	...	...	...	...	...	...	...	1*	...	...	...	...	1†	...	...	...	1†	...	...	...	...	...	* Casella's Anemograph. † Do. out of order.
	Belgaum	...	...	...	...	...	...	...	...	...	..	...	1*	..	...	...	...	...	2†	...	...	...	...	...	* In lieu of one broken. † Do. out of order.

Return of the Instruments issued to each Observatory in 1882-83.—(concluded.)

Provinces.	Stations.	Barometer.	Hygrometer.		Dry maximum thermometer.	Minimum thermometer.		Radiation thermometer.		Anemometer.	Wind Vane.	Rain-gauge.	Measure-glass.	Lens.	Clock.	Sundial.	Sand glass.	Sunshine Recorder.	Pad for glass radiation thermometer.	Cage.	Stand for sun thermometer.	Salinometer.	Common thermometer.	Standard thermometer.	Remarks.
			Dry.	Wet.		Dry.	Wet.	Solar.	Grass.																
Madras, Mysore and Coorg.	Masulipatam	1	1	1	...	1	2	...	1	1	...	1	1	...	1	...	1	...	...	...	...	...	...	...	
	Secunderabad	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	
	Bellary	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Mangalore	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	..	...	...	...	
	Bangalore	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Salem	...	1	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Wellington	...	1	1	...	...	...	...	...	1	...	...	...	...	1	...	..	...	...	...	...	...	...	..	
	Coimbatore	...	1	1	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Trichinopoly	...	...	...	...	...	...	1	1	1	...	1	1	...	...	...	1	...	...	...	...	...	...	...	
	Negapatam	1	...	...	...	...	...	...	1	1	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Cochin	...	...	...	...	...	...	1	1	1	...	1	1	...	...	...	1	...	...	...	...	...	...	...	
	Kurnool	1	1	1	1	1	1	1	1	1	1	1	1	...	...	...	...	...	...	...	...	...	...	...	Original furniture.
	Gopalpore	...	...	...	1	1	...	...	...	...	...	...	..	...	1	...	1	...	...	...	...	...	...	...	Ditto.
	Coconada	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Calicut	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Ditto.
Burma.	Akyab	...	...	...	...	1	1	1	...	...	...	1	1	...	...	...	1	...	...	...	...	...	...	...	
	Thyetmio	...	...	...	...	1	...	...	...		...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Tounghoo	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Bassein	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Diamond Island	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Rangoon	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1	...	...	...	..	...	
	Kailang	2	2	2	2	2	2	...	...	1	1	1	1	...	...	...	...	...	...	1	...	...	...	...	Ditto.
	Alipore	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	2	...	...	...	...	2	
	F. L. V. "Comet"	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	1	..	
	,, "Planet"	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	1	...	
	,, "Meteor"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	
	S. S. "Shahzada"	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	1	...	
	S. S. "Shahjahan"	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	1	...	
	Dehra (Forest School)	...	.	...	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Makhla	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Jodhpur	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	.	..	
	Kilba	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	
	Patuakhali	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	

APPENDIX K.

List of Recipients of the Publications of the Meteorological Office.

Adelaide	Meteorological Observatory.
Agra	The Editor of the *Delhi Gazette.*
Ajmere	Chief Commissioner of Ajmere.
Akola	Sanitary Commissioner for Berar.
Algeria	Le Général Commandant Superieur du Genie en Algerie.
Allahabad	Secretary to the Government, North-Western Provinces and Oudh.
	Department of Revenue and Agriculture, North-Western Provinces and Oudh.
	Meteorological Reporter, North-Western Provinces and Oudh.
	Sanitary Commissioner, ditto ditto.
	Editor of the *Pioneer.*
	The Accountant-General, North-Western Provinces and Oudh.
Amsterdam	Royal Academy of Sciences.
Bangalore	Chief Commissioner, Mysore and Coorg.
	Conservator of Forests, Mysore and Coorg.
Batavia, Java	Meteorological Observatory.
Berlin	Ditto Institute.
Bombay	Secretary to the Government of Bombay.
	Meteorological Reporter for Western India.
	Colaba Observatory.
	Sanitary Commissioner with the Government of Bombay.
	Bombay University.
	Asiatic Society of Bombay.
	Bombay Sassoon Mechanic's Institute.
	Geographical Society of Bombay.
	Editor of the *Bombay Gazette.*
	Ditto *Times of India.*
	Elphinstone College.
Brisbane, Queensland	Observatory.
Brussels	Royal Academy of Sciences.
	Observatoire Royal.
Budapesth	Observatory.
Calcutta	Secretary of State for India (through Revenue and Agricultural Department).
	Secretary to the Government of India, Revenue and Agricultural Department).
	Ditto ditto Home Department.
	Ditto ditto Public Works Department.
	Ditto ditto Foreign Department.
	Ditto ditto Department of Finance and Commerce.
	Ditto ditto Military Department.
	Private Secretary to His Excellency the Viceroy.
	Secretary to the Government of Bengal, Revenue Department.
	Meteorological Reporter to the Government of Bengal.
	Surveyor General of India.
	Superintendent, Geological Survey of India.
	Sanitary Commissioner with the Government of India.
	Ditto ditto ditto Bengal.
	Superintendent, Botanic Gardens, Calcutta.
	Inspector General of Forests, with the Government of India.
	Surgeon-General ditto ditto.
	Asiatic Society, Bengal.
	Indian Museum Library.
	Calcutta University.
	Presidency College.
	Public Library.
	Editor of the *Calcutta Review.*
	Ditto *Statesman and Friend of India.*

List of Recipients of the Publications of the Meteorological Office—(continued.)

Calcutta	Editor of the *Englishman.*
	Ditto *Indian Daily News.*
	Ditto *Hindu Patriot.*
	Ditto *Indian Agriculturist.*
	Reverend E. Lafont, S. J.
	The Alipore Observatory.
	Mint Master.
Cambridge	University Library.
Cambridge, Massachusetts	Harvard University.
Cape of Good Hope	Astronomer Royal.
Carlsruhe, Baden, Germany	Bureau für Meteorologie und Hydrographie.
Chemnitz	Royal Meteorological Institute.
Chatham	Royal Engineer's Library.
Christiania	Norske Meteorologiske Institut.
	Royal Observatory.
Colombo	Editor of the *Ceylon Times.*
	Ditto *Ceylon Observer.*
	Surveyor General of Ceylon.
Constantinople	Observatoire Imperial Météorologique.
Copenhagen	Danske Meteorologiske Institut.
	Royal Danish Academy of Sciences.
Cordoba	Meteorological Office.
Darjeeling	Conservator of Forests, Government of Bengal.
	Editor of the *Indian Forester.*
Dehra Dun	Superintendent, Great Trigonometrical Survey.
Dharwar	Conservator of Forests, Bombay, Southern Division.
Dublin	Royal Dublin Society.
Edinburgh	Scottish Meteorological Society.
	Astronomer Royal for Scotland, Royal Observatory.
Elichpore	Assistant Conservator of Forests, Melghat Division.
Goa	Royal Observatory.
Greenwich	Astronomer Royal, Royal Observatory.
Guatemala	Observatorio Meteorologico del Institut Nacional de Guatemala.
Hamburgh	Nord Deutsche Seewarte.
Havana	Real Collegio de Belen.
Hong-Kong	Superintendent, Government Civil Hospital.
Indore	Agent to the Governor General for Central India in charge of the Residency.
Iowa, U. S.	Iowa Weather Service.
Jubbulpore	Civil Surgeon of Jubbulpore.
Katmandu	Resident at Nepal.
Khandwa	Civil Surgeon of Nimar.
Kitzingen, Bavaria	Dr. Emil Von Schlagintweit.
Kurrachee	Conservator of Forests, Bombay, Sind Division.
Lahore	Secretary to the Government of the Punjab.
	Meteorological Reporter ditto ditto.
	Sanitary Commissioner ditto ditto.
	Conservator of Forests ditto ditto.
	Editor of the *Indian Public Opinion.*
Lisbon	Observatoire de Infante D'Luiz.
	Academy of Sciences.
London	Meteorological Council.
	Royal Society.
	Royal Asiatic Society.
	Society of Arts.
	Meteorological Society.
	Institution of Civil Engineers.
	Royal School of Mines.

List of Recipients of the Publications of the Meteorological Office—(continued.)

London	Admiralty Library.
	United Service Museum.
	British Museum.
	Editor of the *Philosophical Magazine.*
	Ditto *Athenæum.*
	Ditto *Nature.*
	Ditto *Symons's Monthly Meteorological Magazine.*
	Ditto *Westminster Review.*
	Ditto *Quarterly Review.*
Madras	Secretary to the Government of Madras.
	Ditto ditto Public Works Department, Irrigation Branch.
	Meteorological Superintendent to the Government of Madras.
	Government Astronomer, Madras.
	Sanitary Commissioner, Government of Madras.
	Madras University.
	Editor of the *Madras Times.*
	Ditto *Madras Athenæum.*
	Ditto *Madras Mail.*
	Superintendent, Government Central Museum.
	The Agricultural Reporter, Government of Madras, Saidapet.
	Surgeon General, British Medical Department.
	Ditto Indian Medical Department.
	Master Attendant of Madras.
Madrid	Royal Observatory.
Manchester	Literary and Philosophical Society.
Manila	Meteorological Observatory.
Mauritius	Meteorological Society.
Melbourne, Victoria	The Observatory.
	University Library.
	Public Library.
Mexico	Central Meteorological Observatory.
Milan	Royal Astronomical Observatory.
Munich	Royal Observatory.
	Royal Bavarian Academy of Sciences.
	Geographical Society.
	The Publishers of the *Deutsche Rundschau für Geographie und Statistik.*
Nagpur	Chief Commissioner, Central Provinces.
	Sanitary Commissioner ditto.
	Inspector General of Education, Central Provinces.
	Civil Surgeon, Central Jail.
	Conservator of Forests, Central Provinces.
Naini Tal	Ditto ditto North-Western Provinces and Oudh.
New Haven, Connecticut	Connecticut Academy of Arts and Sciences.
	Editors of the *American Journal of Sciences.*
New York, U. S.	Central Park Observatory.
Ootacamund	Conservator of Forests, Government of Madras.
	Editor of the *South of India Observer.*
Oxford	Radcliffe Library.
	Radcliffe Observer, Radcliffe Observatory.
Paris	Observatoire Physique Central de Montsouris.
	Editor of *La Nature.*
	Physical Observatory, Meudon.
	Bureau Central Météorologique.
Perpignan, France	Commission Métérol. des Pyréness Orientales.
Perth, W. Australia	Surveyor General.
Pesaro, Italy	Royal Observatory.

List of Recipients of the Publications of the Meteorological Office—(concluded.)

Philadelphia	Franklin Institute.
Poona	Conservator of Forests, Bombay, Northern Division.
Prag, Bohemia	Observatory.
Raipur	Civil Surgeon of Raipur.
Rangoon	Chief Commissioner, British Burma.
	Sanitary Commissioner ditto.
	Conservator of Forests ditto.
	Editor of the *Rangoon Times*.
Rome	Meteorological Office (Ministry of Agriculture).
Rio de Janeiro	Imperial Observatory.
Shaharunpore	Superintendent, Botanic Gardens.
Secunderabad	Secretary to the Resident at Hyderabad.
Shillong	Ditto Chief Commissioner of Assam.
	Deputy Conservator of Forests . ditto.
Simla	Quarter-Master General of India, Intelligence Branch.
Singapore	Principal Civil Medical Officer, Straits Settlements.
Stockholm	Nautisk Meteorologiska Byran.
St. Petersburgh	Observatoire Physique Central.
Strasburg	Imperial University Library.
Sydney	Observatory.
	University Library.
Syracuse, Sicily	Royal Meteorological Observatory.
Tasmania	Royal Society.
Tiflis, Russia	Physical Observatory.
Tokei, Japan	Imperial Mining Office.
	Imperial Meteorological Observatory.
Toronto, Canda	Magnetical and Meteorological Observatory.
Turin	R. Osservatorio Astronomico di Torino.
Upsala	Meteorological Observatory.
Utrecht	Royal Dutch Meteorological Institute.
Vienna	K. K. Central Anstalt für Meteorologie und Erdmagnetismus.
	K. K. Geologische Reichsanstalt.
	Imperial Academy of Sciences.
	Dr. J. Hann.
Vizagapatam	A. V. Nursingrow, Esquire.
Washington, U. S.	Chief Signal Officer, United States Army.
	Smithsonian Institution.
	Naval Observatory.
	Hydrographic Office.
	Professor Cleveland Abbe, Signal Office.
Wellington, New Zealand	Observatory.
Woolwich	Royal Artillery Library.
Zi-ka-wei, Shanghai	Magnetical and Meteorological Observatory.
Zurich	Central Meteorological Institute.

APPENDIX L.

Presentations to the Library from the 1st April 1882 to the 31st March 1883.

Place.	Donors.	Title of Work.
ADELAIDE	Meteorological Observatory	Meteorological Observations made at the Adelaide Observatory during the year 1879.
ALGIERS	Meteorological Service	Bulletin Météorologique du Gouvernment général de l'Algérie, Nos. 1227, 1472, 1802, 2280 to 2581, 2583 to 2657.
		Elements et image photographique de la Cométe *b*, 1881.
		Resumé climatologique de l'anné 1881, January to May 1882.
		Regime pluvial de l'Algérie de 1854 à 1880.
		Tableau recapitulatif des quantités de pluie tombées quotidiennement, January to May 1882.
		Quantités de pluie tombées mensuellement dans les stations de l'Algérie. Saison pluviense, 1881-82.
ALLAHABAD	Meteorological Office	Administration Report of the Meteorological Reporter to the Government of the North-Western Provinces and Oudh for the year 1881-82.
		Sketch of the Meteorology of the year 1881 in the North-Western Provinces and Oudh and Eastern Rajputana.
AMSTERDAM	Royal Academy of Sciences	Jaarboek, 1880.
		Verslagen en mededeelingen aft Natuurkunde, Vol. XVI.
		Processen Verbaal, 1880-81.
BATAVIA	Magnetical and Meteorological Observatory.	Observations made at the Magnetical and Meteorological Observatory at Batavia, Vol. V, part 6, with title page.
		Rainfall in East Indian Archipelago, 3rd year, 1881.
BERLIN	Messrs. Mayer and Müller	Acta Mathematica, No. 1.
	Meteorological Institute	Preussische statistik LXIV. Ergebnisse der Meteorologischen Beobachtungen im Jahre 1881.
BOMBAY	Government of Bombay	Eighteenth Annual Report of the Sanitary Commissioner for the Government of Bombay for 1881.
		Bombay Gazetteer Vols. II to VI, X, XII, XIII, part 1; Vols. XII and XIV, part 2.
	Meteorological Office	Brief sketch of the Meteorology of the Bombay Presidency in 1881.
BRERA	R. Specola di Brera	Osservazioni meteorologichi, 1880 and 1881.
CALCUTTA	Dr. D. Brandis	On the distribution of Forests in India.
	Geological Survey of India	Memoirs, Vol. IV, parts 2 and 3; Vol. V, parts 1, 2, 3; Vol. VI, parts 1 and 2; Vol. VII, parts 1, 2, 3; Vol. VIII, parts 1 and 2; Vol. IX, parts 1 and 2; Vol. X, part 2; Vol. XI, part 1; Vol. XVII, part 1; Vol. XIX, part 3.
		Records, Vols. I to XV and Vol. XVI, part 1.
	Government of Bengal	Report on the External Trade of Bengal with Nepal, Sikkim and Bhutan, for the year 1881-82.
		Report on the Administration of Bengal for 1881-82.
	Comptroller General	Civil Account Code, Vol. I, 2nd edition.
		Civil Estimates for 1882-83.
	G. A. Depenning	Lecture on "Gravity."
	Government of India, Home Department.	A Manual of the land revenue systems and land tenures of British India.
		Suggestions regarding the demarcation and management of the Forests in Kulu by W Schlich, Ph.D.
		Report of the Meteorological Council to the Royal Society for the year ending 31st of March 1882.
	Government of India, Revenue and Agricultural Department.	Report of the Famine Commission, Appendix V. Irrigation as a protection against famine.

Presentations to the Library from the 1st April 1882 to the 31st March 1883—(continued.)

Place.	Donors.	Title of Work.
CALCUTTA—*contd.*	Government of India, Revenue and Agricultural Department—*contd.*	Report of the Famine Commission, Appendix II. Proceedings of the Commission and selected evidence.
		Report on the Census of Berar, 1881.
		Report on the Census of British Burma taken on the 17th February 1881.
		Census of the Native States of Rajputana, 1881.
		Census of the province of Ajmere and Merwara taken on the 17th February 1881.
		Report on the condition and proceedings of the Government Observatory, Colaba, for the year which ended with the 30th June 1882.
		Report of the Census of the North-Western Provinces and Oudh, 1881.
		Supplement to the Census of the North-Western Provinces and Oudh, 1881.
		The Travelling Allowance Code, 1883.
	John Eliot, Esq., M.A.	The rainfall of Cheerapunji.
	Sanitary Commissioner for Bengal.	Fourteenth Annual Report of the Sanitary Commissioner for Bengal, 1881.
	Sanitary Commissioner with the Government of India.	Eighteenth Annual Report of the Sanitary Commissioner with the Government of India, 1881.
	St. Xavier's College Observatory	Meteorological Observations recorded at the St. Xavier's College Observatory from January to December 1882.
	Surveyor General of India	General Report on the Operations of the Survey of India during 1880-81.
CALIFORNIA	Dr. J. H. C. Bonte	The northerly winds of California.
CAMBRIDGE	Harvard College Observatory	Statement of the work done at the Harvard College Observatory during the years 1877 to 1882.
CAPE OF GOOD HOPE	Meteorological Commission	Report of the Meteorological Commission for the year 1881.
COPENHAGEN	Institut Météorologique Danois	Bulletin Météorologique du Nord, February to December 1882, and January 1883.
		Annuaire météorologique pour l'année 1880, Part II.
	Kongl. Danske Videnskabernes Selskabs.	Oversigt Nos. 1, 3 of 1881; No. 2 of 1882.
CORDOBA	National Observatory	Annales de la Oficina meteorologica Argentina, Tomo II.
DEHRA DUN	Great Trigonometrical Survey of India.	Account of the Operations of the Great Trigonometrical Survey of India, Vols. VII and VIII.
EDINBURGH	C. Piazzi Smyth	Madeira Meteorologic.
		Madeira Spectroscopic.
	Royal Society of Scotland	*Piazzi-Smyth.*—Gaseous spectra in vacuum tubes.
		Constitution of the lines forming the low temperature spectrum of Oxygen.
	Scottish Meteorological Society	Journal of the Scottish Meteorological Society, New Series, Nos. LXIV to LXIX.
GOA	Meteorological Observatory	Observacoes meteorologicas de Goa 10 Semestre di Anno de 1881.
GREENWICH	Royal Observatory	Greenwich Magnetical and Meteorological Observations for 1880.
GUATEMALA	Institute Nacional de Guatemala	Meteorological Observations, May to August 1881.
HAMBURGH	Deutsche Seewarte	Wetterbericht, Vol. VI, Nos. 119 to 132; Vol. VII, Nos. 32 to 365; Vol. VIII, Nos. 1 to 31.
		Monatliche Uebersicht der Witterung, April 1879, August 1880, October to December and year 1881, January to August 1882.
	Max Möller	Beziehungen zwischen dem ober-und Unterwinde einer Depression, &c., by Max Möller (Pamphlet).
		Beiträge zur Kenntniſs der atmosphärischen Wirbel und ihrer Beziehung zur Cirruswolke. The same (Pamphlet).
HONG-KONG	Government of Hong-Kong	Meteorological Observations taken at Hong-Kong April to June 1881; February to November 1882; January 1883.

Presentations to the Library from the 1st April 1882 to the 31st March 1883—(continued.)

Place.	Donors.	Title of Work.
IOWA . . .	Iowa Weather Service . . .	Notes on cloud forms and the climate of Iowa.
		Iowa Weather Service Annual Report, 1883.
		Second Biennial Report of the central station of the Iowa Weather Service.
KARLSRUHE . .	Baden Meteorological Observatory .	X, XI, XII, XIII, Jahresbericht der Grossherz, Badischen meteorologischen central Station Karlsruhe für die Jahre, 1878 *bis* 1881.
LAHORE . . .	Government of the Punjab . .	Report on the revised land revenue settlement of the Rohtak District, 1873-1879.
	Meteorological Office . . .	Meteorological Report for 1881.
LONDON . .	G. J. Symons, Esq. . . .	Symons's Monthly Meteorological Magazine; April and November 1881, March to December 1882, January and February 1883.
	Kew Committee of the Royal Society	Report of the Kew Committee for the year ending 31st October 1882.
	Meteorological Office . .	Weekly Weather Report. Title page of Vols. IV and V; Vol. V, Nos. 8 to 52; Vol. VI, Nos. 1—8.
		Daily Weather Reports, January to December 1881.
		Hourly readings from the self-recording instruments at the seven observatories, October to December 1880.
		Bulletin International. Bureau Central Météorologique de France, 1881.
		Report of the Meteorological Council to the Royal Society for the year ending 31st March 1881.
		Results of observations made at the Pagoda Royal Gardens, Kew, and elsewhere, to determine the influence of height on thermometric readings on vapour tension and on humidity.
		Meteorological charts for the ocean districts adjacent to the Cape of Good Hope.
		Remarks explanatory of the meteorological charts of the ocean districts adjacent to the Cape of Good Hope.
		Report of the storm of 13th to 14th October 1881.
		Meteorological Observations at six stations of the second order for the year 1879.
		Contributions to our knowledge of the meteorology of the Arctic regions, part 3.
		Report on the gales experienced in the ocean districts adjacent to the Cape of Good Hope, between Lat. 30° and 50° S., and Long. 10° and 40° E.
	Meteorological Society . .	Quarterly Journal. New Series, Vol. VIII, Nos. 41 to 44.
		List of fellows of the Meteorological Society on 1st March 1882.
		The Meteorological Record, Nos. IV to VII.
	The Publishers	The Colonies and India, Nos. 502 and 523.
	Royal Asiatic Society . . .	Journal, Vol. XIV, parts i, ii and iv.
	Royal Society	Proceedings, Nos. 216 to 221.
	Society of Arts	Journal Nos. 1529 to 1575, 1577 to 1581.
MADRAS . . .	Government of Madras . .	The Ganjam District Manual.
		Manuals of the Chingleput (late Madras), Nilgiri, Godavery, Tinnevelly, Nellore, North Arcot, and Trichinopoly districts.
		Suggestions regarding Forest administration in the Madras Presidency.
	Meteorological Office . . .	Administration Report of the Meteorological Reporter to the Government of Madras for 1881-82.
MANILLA . . .	Observatorio del ateneo Municipal de Manila.	Ligeros Apuntes sobre el huracan del 20 de Octubre de 1882.
MAURITIUS . .	Meteorological Society . . .	Mauritius Meteorological results for 1879 and 1880.
MELBOURNE . .	Meteorological Observatory . .	Monthly Record of results of observations in Meteorology, Terrestrial Magnetism, &c., taken at the Melbourne Observatory from June to December 1881 and January to April 1882.

Presentations to the Library from the 1st April 1882 to the 31st March 1883—(continued.)

Place.	Donors.	Title of Work.
MEXICO	Central Meteorological Observatory.	Boletin, Tomo VI, Nos. 133 to 179, and 185 to 198; Tomo VII, Nos. 1 to 124; Tomo VIII, Nos. 1—7.
		Revista mensual climatologica, Tomo I, Nos. 10, 11, 13, 14.
		Anales del ministerio de Fomento, Tomo VI.
		Revista Cientifica Mexicana, Tomo I, Nos. 18 to 23.
MILAN	Reale Osservatorio di Brera	Osservazioni meteorologiche orarie ottenute da strumente registratori durante l'anno, 1880.
		Operazioni eseguite nell'anno, 1879, per determinare la differenza di longitudine fra gli osservatorio astronomici del compidoglio in Roma e di Brera in Milano.
MUNICH	K. Sternwarte	Meteorologische und Magnetische Beobachtungen, Jahrgang 1882.
	The Publishers	Deutsche Rundschau für Geographie und Statistik, Vol. IV, Nos. 7—10 and 12, and Vol. V, Nos. 1 to 6.
MANCHESTER	Professor Balfour Stewart, LL.D., F.R.S.	An Analysis of the recorded diurnal ranges of the magnetic declination, with the view of ascertaining if these are composed of inequalities which exhibit a true periodicity.
		Preliminary report to the Solar Physics Committee on a comparison for 2 years between the diurnal ranges of magnetic declination as recorded at the Kew Observatory, and the diurnal ranges of atmospheric temperature as recorded at the observatories of Stonyhurst, Kew and Falmouth.
NAGPUR	Chief Commissioner, Central Provinces.	Report on the trade and resources of the Central Provinces for the year 1881-82.
NEW HAVEN	Connecticut Academy of Arts and Sciences.	Transactions of the Connecticut Academy of Arts and Sciences, Vol. IV, part 2; Vol. V, part 2.
	Professor Elias Loomis	Contributions to Meteorology, 17th and 18th paper.
		Mean annual rainfall for different countries of the globe.
NEW YORK	Meteorological Observatory	Abstract of registers from self-recording instruments, December, and annual tables for 1881, and January to November 1882.
OXFORD	Radcliffe Observatory	Results of Meteorological Observations made at the Radcliffe Observatory, Oxford, in the year 1880.
PARIS	Bureau Central Météorologique de France.	Bulletin international, Vol. XXV, Nos. 238, 268 to 272; Vol. XXVI, Nos. 48 to 173, 175 to 331, 335 to 365; Vol. XXVII, Nos. 1 to 60.
		Supplement, Nos. 31, 59, 90, 143, 120, 181, 243, 274, 334.
		Rapport du Comité météorologique international, Réunion de Berne, 1880.
	Mons. F. F. Hibert	Théses presentées à la faculté des Sciences de Paris.
	Mons H. Brocard	Memoires de météorologie dynamique.
	Societe Météorologique de France	Annuaire de la Société météorologique de France, 29e Année, 1881; 3rd and 4th Trimestre; 30e Année, 1882; March and April.
PERTH, WESTERN AUSTRALIA.	Meteorological Branch, Survey Office.	Western Australia Meteorological Report for 1878 and 1881.
PHILADELPHIA	Franklin Institute	Journal, Vol. CXII, No. 672; Vol. CXIII, Nos. 674 to 678; Vol. CXIV, Nos. 679 to 685.
PRAGUE	K. K. Sternwarte	Astronomische magnetische und meteorologische Beobachtungen Jahre, 1881.
	Professor Dr. Franz Augustin	Uber den täglichen Gang des Regenfalles.
		Uber den täglichen Gang des Luftdruckes und der Lufttemperature in Prag
RIO DE JANEIRO	Imperial Observatory	Bulletin astronomique et météorologique, October to December 1881, and January to December 1882.
SIMLA	Inspector-General of Forests with the Government of India.	Suggestions regarding Forest Administration in the N.-W. Provinces and Oudh.
		Review of the Forest Administration in the several provinces under the Government of India for the year 1880-81.
SINGAPORE	Colonial Surgeon, Straits Settlements.	Meteorological Returns for 1880 and 1881.
		Rainfall Returns for 1880 and 1881.

Place.	Donors.	Title of Work.
St. Petersburgh	International Polar Commission	Communications from the International Polar Commission, parts 2, 3.
	Physical Central Observatory	Repertorium für Météorologie, Band VII, Heft 2.
		Annalen des physicalischen Central observatoriums Jahrs 1880, 1881. Transit of Mercury.
Sydney	Meteorological Office, New South Wales.	Results of rain and river observations made in New South Wales during 1881.
	Observatory	Results of double star measures made at the Sydney Observatory, 1871—81.
		Abstract of meteorological observations, New Zealand, for the quarter ending 30th June 1882.
Syracuse	Osservatorio Centrale di Siracusa	Osservazioni meteorologichi, Anno VI, Nos. 1—6, 8 to 12.
Tasmania	Royal Society of Tasmania	Reports of the Royal Society of Tasmania for 1879, 1880, 1881.
Tiflis	Physical Observatory	Magnetische Beobachtungen des Tifliser physicalischen observatoriums in den Jahren 1880 and 1881.
Tokio	Imperial Meteorological Observatory.	Meteorological observations recorded at Tokio from November 1881 to May 1882; at Kioto, Nügata, Hiroshima, and Nagasaki from October 1881 to June 1882; at Nobiru from July 1881 to April 1882; at Wakayama from June 1881 to April 1882; at Aomori from January to June 1882; at Kanazama for January, February, May, and June 1882; and at Kochi from March to June 1882.
	Tokio University	Report on the Meteorology of Tokio for 1880.
Toronto	Meteorological Office	Monthly weather review, January to December 1879; May and August 1880; February to December 1882; January 1883.
		General Meteorological Register for 1882.
		Report on the Meteorological Service of the dominion of Canada for the year ending 31st December 1880.
Turin	Royal Observatory	Effemeridi del sole, della luna e dei principali pianate per l'anno, 1883.
		Sulla rifrazione—Interpretazione matematica dell ipotesi.
		Bolletino dell' osservatorio della regia Universita di Torino, Anno XVI (1881).
Upsala	Meteorological Observatory	Bulletin météorologique mensuel, Vol. XVII, Année 1881; Vols. I to VIII, Année 1869 to 1876.
		Observations météorologiques horaires du 30 Mars 1865 au 9 Août 1868.
Vienna	Dr. J. Hann	Zeitschrift der Oesterr. Meteor. Geselschaft, XVII Band, 1882, March to December; XVIII Band, 1883, January to March.
	K. K. Central Austalt für Meteorologie und Erdmagnetismus.	Jahrbuch Neue Folge, XV, Band, Jahrg, 1878; XIII Band, Jahrg, 1881.
		Magnetische Beobachtungen, 1879 and 1880.
		Stundliche Aufzeichnungen der autographischen Apparate für Luftdruck, Temperatur, Geschwindigkeit und Richtung des Winds am Observatorium der K. K. Centralanstalt für Meteorologie und Erdmagnetismus auf der hohen Warte bei Wien. Jahrgs, 1878 to 1881.
		Jahrbuch, Jahrgang 1878.
		Ditto ditto 1880, Erster Theil.
	K. K. Geologische Reichsanstalt	Verhandlungen, 1881, Nos. 8 to 18, with title page; 1882, Nos. 1 to 11.
	K. K. Meteorologisches, Central Observatorium.	Internationaler telegraphischer Wetterbericht, Jahrg, VI, Nos. 36—365; Jahrg VII, Nos. 1 to 59.
	Royal Academy of Sciences	*Brezina.*—Bericht über neue oder wenig bekannte Meteoroten IV.
		Exner.—Über das Funkeln der Sterne und die Scintillation überhaupt.
		Gruss.—Bahnbestimmung des Kometen V, 1877.
		Hann.—Über die monatlichen und jährlichen Temperatur Schwankungen in Österreich-Ungarn.
		Hann.—Über den Fohn in Bludeuz.
		Koch.—Bericht über den am 3. Februar I. J. Sattgefundenen Meteorsteinfall vou Mocs in Siebenbürgen.

Presentations to the Library from the 1st April 1882 to the 31st March 1883—(concluded.)

Place.	Donors.	Title of Work.
VIENNA—*contd.*	Royal Academy of Sciences—(*contd.*)	*Lippich.*—Über polaristrobometrische Methoden.
		Liznar.—Resultate magnetischer Messungen in Mähren und Schlesien.
		Hann.—Über die Temperatur der südlichen Hemisphäre.
		Tinter.—Über den Fehler beim Einstellen des Fadenkreuzes in die Bildebene.
		Brezina.—Über die Reichenbach'schen Lamellen in Météoreisen.
		Brezina—Über die Orientirung der Schnittflächen an Eisenmeteoriten mittelst der Widmannstädten'schen figuren.
		Wüllerstorf-urbair.—Die meteorologischen Beobachtungen am Bord des Polarschiffes, "Tegetthoff," Weyprecht, 1872—74.
		Anzeiger der Kaiserlichen Akademie der Wissenschaften Jahrg, 1881, Nos. XX to XXVIII, with index; Jahrg, 1882, Nos. I to XVII.
WASHINGTON	Chief Signal Office	Bulletin of International Meteorological Observations, 25th July to 31st December 1880; 1st February to 31st August 1881.
		Monthly weather review, 1881, October to December; 1882, January to November.
		Daily charts, 1st to 31st December 1880.
		Report of the Chief Signal Officer, War Department, 1879.
		Annual Report of the Chief Signal Officer of the Army, to the Secretary of War for 1822.
		Professional papers of the Signal Service No. 1. Total Eclipse of the Sun July 1878, Abbe. No. 2. Isothermal lines of the United States, 1871—80. No. 3. Chronological list of Auroras observed from 1870 to 1879. No. 4. Tornadoes of May 29th and 30th, 1879. No. 5. Information relative to the construction and maintenence of Time-balls. No. 6. The reduction of air pressure to sea-level, at elevated stations west of the Mississipi river.
	Naval Observatory	Instructions for observing the transit of Venus, December 6th, 1882.
	Smithsonian Institution	Annual Report of the Board of Regents of the Smithsonian Institution for 1880.
		List of foreign correspondents of the Smithsonian Institution corrected to January 1882.
	United States Coast and Geodetic Survey.	Methods and results, meteorological researches, part 3, barometric hypsometry and reduction of the barometer to sea-level.
WELLINGTON, NEW ZEALAND.	Meteorological Office	Abstract of meteorological observations, New Zealand, for the quarters ending 31st December 1881 and 31st March 1882.
ZI-KA-WIE	Magnetical and Meteorological Observatory.	Bulletin Mensuel, September 1881, and January to September 1882.
		Eclipse totale du soleil du 17th Mar 1882.
		The typhoons of the Chinese seas in the year 1881.
ZURICH	Swiss Meteorological Institute	Meteorologische Beobachtungen, January to December 1882.
		Meteorologische Beobachtungen, 1879.

Purchases for the Library.

Ager's Standard Telegram Code of 100,000 words.
American Journal of Science, January 1877; February to December 1882; January and February 1883.
Annalen der Physik und Chemie, Nos. 3 to 13 of 1882; Nos. 1 to 3 of 1883.
Comptes Rendus, Tome XCIV, Nos. 9 to 26; XCV, Nos. 1 to 26; XCVI, Nos. 1 to 9.
Tables des Comptes Rendus, &c., 1881, XCIII; 1882, XCIV.
La Nature, Nos. 458 to 466, 468, 470 to 493, 495 to 502, 504 to 510.
Nature, Nos. 645 to 661, 663 to 680, 682 to 685, 688 to 697; Title page and index for Vol. XXV.
Philosophical Magazine, Nos. 80 to 90 of 1882; 91 & 92 of 1883.
Report of the British Association for 1881.
Royal Society Catalogue of Scientific Papers, Vols. VII and VIII.
Workshops Receipts by Ernest Spon.

APPENDIX M.*

List of Officers in Charge and Assistants in the Madras Presidency, Meteorological Department, in the official year 1882-83.

STATION.	Officer in Charge.	From	To	Assistant.	From	To
Madras	Miss E. Isis Pogson, F.M.S., Meteorological Reporter and Assistant Government Astronomer	1st April 1882	31st March 1883	T. Vythinath Iyer, First	1st April 1882	31st March 1883.
				N. E. Kangayam Pillay, Second	1st April ,,	31st March ,,
Amini Divi	Syed Abdool Rahaman	1st April ,,	31st March ,,	......	......	......
Bangalore	Surgeon P. H. Benson, M.B.	1st April ,,	31st March ,,	Rungasawmy Moodilair	1st April ,,	31st March ,,
Bellary	Surgeon-Major H. M. G. Archdall	1st April ,,	8th April 1882	B. G. Sashachellum, First	1st April ,,	31st March ,,
	Surgeon A. P. Adams	9th April ,,	30th May ,,	Sreenevasa Row, Second	1st April ,,	31st March ,,
	Surgeon-Major H. M. G. Archdall	31st May ,,	31st March 1883	......	......	......
Cochin	Surgeon A. T. O'Hara	1st April ,,	23rd May 1882	......	......	......
	Brigade-Surgeon W. H. Morgan	24th May ,,	31st March 1883	G. Narayanasawmy	1st April ,,	31st March ,,
Coimbatore	Surgeon G. M. E. McKee	1st April ,,	1st May 1882	......	......	......
	Surgeon-Major T. F. Fitzpatrick, M.D.	2nd May ,,	31st March 1883	Varadiah Naidu	1st April ,,	31st March ,,
Kurnool	Telegraph Master, A. Wale	9th February 1883	31st March ,,	......	......	......
Madura	Surgeon T. Lancaster, M.B.	1st April 1882	29th August 1882	......	......	......
	Surgeon T. Leonard	30th August ,,	15th October ,,	V, Sashachellum	1st April ,,	31st March ,,
	Surgeon-Major H. J. Hastings, M.D.	16th October ,,	31st March 1883	......	......	......
Mangalore	Telegraph Master F. D'Souza	1st April ,,	31st March ,,	......	......	......
Masulipatam	Surgeon F. T. Doyle	1st April ,,	8th April 1882	......	......	......
	Surgeon H. St. Clair Carruthers	9th April ,,	31st March 1883	Uma Ranganayahala Naidu	1st April ,,	31st March ,,
Mercara	Telegraph Master H. Duchworth	1st April ,,	31st March ,,	......	......	......
Negapatam	E. N. Monis, Esq., L.R.C.P., F.R.C.S.E.	1st April ,,	31st March ,,	S. Saminatha Iyer	1st April ,,	31st March ,,
Salem	Surgeon-Major H. T. Hazlett	1st April ,,	20th April 1882	......	......	......
	Surgeon F. T. Doyle	21st April ,,	25th May ,,	L. Ramsing	1st April ,,	31st March ,,
	Surgeon-Major H. T. Hazlett	26th May ,,	31st March 1883	......	......	......

Secunderabad	Surgeon E. M. Damla	1st April 1882	1st July 1882	*......	......	......
	Surgeon-Major E. Fawatt, F.R.C.S.	2nd July ,,	31st March 1883	J. T. Williams	1st April 1882	31st March 1883
Trichinopoly	Surgeon-Major J. B. Thomas, L.R.C.P.L.	1st April ,,	31st March ,,	T. Lutchman, First	1st April ,,	31st March ,,
				E. M. Bhojarajooloo, Second	1st April ,,	31st March ,,
Wellington	Surgeon-Major T. Fleming, M.D.	1st April ,,	23rd October 1882	Sergeant H. Brownsell	1st April ,,	31st March ,,
	Surgeon K. D. L. Kirkwood	24th October ,,	2nd November ,,			
	Surgeon-Major A. Long, M.D.	3rd November ,,	31st March 1883.			

---

* This was received after the Report and Appendices was in type.

Government of India Central Printing Office.—No. 63 Meteor.—3-10-83.—400.

REPORT

ON

THE ADMINISTRATION

OF THE

METEOROLOGICAL DEPARTMENT OF THE GOVERNMENT OF INDIA

IN

1883-84.

In accordance with the practice of previous years, I preface the formal portion of my report on the working of the Meteorological Department in the year ending 31st March 1884, with a brief notice of some of the more important incidents of the year, and of the subjects to which attention has been more particularly directed.

Actinometric Observations.—In the report for 1882-83, I recounted the steps taken, up to date, for training the actinometric observers to be sent to Leh, and to verify, by an ample comparison with arbitrary standards, the instruments they were to take with them. As the supply of the latter, originally sent out, proved to be in part of inferior quality, and had been seriously reduced by breakage, it was necessary to detain the observers in India until the arrival of a further supply of thermometers and the completion of their subsequent verification. The instruments arrived in May 1883, but the season of clear skies was now at an end; and although every available opportunity was utilized for carrying on the work during the rains, it was not until the end of September that it was brought to a close,—the instruments packed for safe transport across the passes, and every thing made ready for the start. Sergeant Rowland and Mr. Shaw left Dehra on the 2nd October, and reached Leh, *viâ* Murree and Srinagar, after a month's journey, arriving there on the 2nd November. All the instruments arrived in excellent order.

Their work at Dehra had been carried on under the direction and personal superintendence of Mr. Hennessey, who devised several improvements in the instruments, and organised the scheme of their work. The results of this experience he has embodied in a pamphlet of elaborate instructions, specially drawn up for the guidance of the observers,—itself an important contribution to science, and which will probably serve as the basis and guide for all future systematic work in actinometric observation. I cannot omit to repeat the expression of my great indebtedness to Mr. Hennessey, for his valuable co-operation in organising the scheme and directing the preparations for the important work now in progress.

I have received the results of the observers' work, for the months that have elapsed since their arrival at Leh up to the end of May. Hitherto the season has proved most unfavourable. The winter and spring months have been unusually stormy in the North-Western Himalaya, the skies have been greatly obscured by cloud, and opportunities for good observation have been very rare. This is to be regretted; but it was to be anticipated that the winter observations would prove more interrupted than those of the summer, and it is to those of the summer season, when the declination of the sun is higher, the thickness of the absorbing atmosphere consequently less, and the serenity of the skies greater, that we must look for the most important results of the work.

HIMALAYAN SNOWFALL REPORTS.—In last year's report, I set forth the reasons which have led me to attach great importance to the acquisition of detailed and regular information on the state of the Himalayan snows and of the weather prevailing over the higher ranges of the mountains. And in accordance with the recommendations of the report, those passages which bore on this subject were extracted and widely circulated to officers stationed in the hill states, and whose duties bring them into communication with travellers and traders in the interior of the mountains, with the request that they would endeavour to obtain and communicate speedily to this office, from month to month, the fullest information procurable on the extent and thickness of the snows. As the result of these measures, the statistical accounts received of the snowfall of the past winter and spring have put me in possession of a body of most valuable information,—the more valuable that, throughout the higher ranges to the north-west of the Sutlej, the snowfall of the past winter and spring has been unusually heavy, while that of the outer ranges, from Kangra eastwards, has been as conspicuously deficient, and that of the inner ranges of the Central Himalaya has been much below the average. The distribution of the snows being thus known, we are enabled to trace out, with more precision than hitherto, the influence of the snow fields on the dry winds of the plains, and in this respect the experience of the present year will prove more than ordinarily instructive.

CONNECTION OF THE SNOWS WITH DRY LAND WINDS.—The views put forward in last year's report of the influence of the snows as favouring the prevalence of dry westerly winds in Northern India have been so far uniformly confirmed by the further experience of the past year.

In the spring of 1883, there was a heavy and late precipitation on the first or outer snowy range of Hazara, Murree, Kangra, Kulu, and Bussahir; and, relying on the experience previously gained, I ventured to put forward a warning in the *Gazette of India* of the 2nd June, to the effect that the monsoon rainfall of the North-Western India would probably be retarded, and that there would be a long spell of dry winds on the plains. The result was that an interrupted, sporadic, but locally heavy rainfall in the first half of July was followed by a long break, which began in the Punjab, speedily extended to the North-Western Provinces, Rajputana, Khandesh, Berar, and even the Konkan and Deccan, and lasted up to nearly or quite the end of August.

A further confirmation of the above view was afforded by the meteorology of the winter months. As a general rule, little or no snow falls on the Himalaya before Christmas or the beginning of the new year, and it is then accompanied by a more or less copious rainfall on the plains of North-Western India. Last season, however, there was a fall of snow in Kashmir as early as September, and very generally on the North-Western Himalaya in October; and early in November a very heavy fall took place everywhere to the north-west of the Sutlej. The cold season which followed on the plains and the outer Himalaya was remarkably fine,—dry cool north-west winds prevailed, with unbroken steadiness; and in Northern India, over the greater part of the Gangetic plain, and in a large area of Western India, the four months, November to February, were absolutely rainless.

Judging from present appearances, the experience of the approaching monsoon will furnish further valuable evidence as to the influence of the snows; the spring fall in Kashmir and Lahoul having been unusually heavy and also prolonged.

A paper on the connection of the Himalayan snowfall with dry winds and seasons of drought in India was lately communicated to the Royal Society of London and read at the meeting of the 1st May. In this paper, which I understand will shortly be published in the Proceedings of the Society, I have given a *resumé* of the evidence from which the above connection has been inferred. Each successive year will add to this evidence, and develop the precise character of the connection, and I anticipate, with confidence, that before many years shall have elapsed, it will be possible to forecast the prospects of any given season, at all events for North-Western India, with more precision than has hitherto been possible for this or any other country in the world.

HIMALAYAN OBSERVATORIES.—Hitherto, with the exception of Leh on the Upper Indus Valley, the only observatories for the registration of Himalayan meteorology have been those at the hill stations,—Murree, Simla, Chakrata, Mussooree, Pauri, Ranikhet, Pithoragarh, Katmandu, and Darjeeling,—all of which are on or among the outer hills, at some distance from the permanent snows. It has long been an object to obtain additional meteorological registers from the interior of the mountain tract, but there has been some difficulty in effecting this, owing to the paucity of residents, of sufficient education and intelligence to undertake the charge of the work. During the past year, through the kindly volunteered assistance of the Rev. A. Heyde, an observatory has been established at Kailang, in Lahoul, at an elevation of 10,000 feet above the sea, and to the north of the second snowy range. Mr. Heyde has been at much pains to establish the instruments in accordance with the official instructions and to obtain a properly trained observer, and in addition to the registers, which were commenced in July 1883, his personal observations on various meteorological phenomena are particularly valuable, and such as can only be furnished by an educated and observant person.

Another observatory, less remote but still within the influence of the snowy range, has lately been fitted up at Chamba, with the kind assistance of Major C. H. Marshall, the Superintendent of the Chamba State, and Dr. Hutchinson, the Resident Medical Missionary. I expect shortly to receive registers from this observatory.

INSULAR OBSERVATORIES.—With a view to ascertaining, as far as possible, the current meteorological conditions of the oceanic region, which is the source of the Indian summer monsoon, observatories have been established at Zanzibar, the Lakhadives, and the Seychelles. That at Zanzibar has now contributed registers since January 1880, first as a voluntary observatory; and in 1881, being brought on the list of paid observatories, it was raised to the status of one of the second class. The work has continued good, and it would be a serious loss were it now to cease. Last year there appeared to be some danger of this, owing to the transfer of the political establishment of the station to Her Majesty's Foreign Office[1] and the consequent withdrawal of the medical officer, who has superintended the observatory. The Surgeon-General of Bombay has allowed the observer to remain at his post for a time, pending the reply of Her Majesty's Government to the application that the observatory may be taken over by the Foreign Office and continued. As yet no reply has been received to this application.[2]

The observatory at Amini Divi was established in September 1880, although no report of the fact was received until long afterwards, and no mention is made of it in the Administration Report for that year. The observer, a subordinate medical officer, was trained in Madras, but it would appear that either the man was naturally inefficient, or his training imperfect. In any case, his registers are of little value. Those from January 1881 to April 1882 have been entirely rejected, and those for the subsequent months of 1882 are very imperfect, while they have ceased altogether since that date. This observer has been recalled, and he has been succeeded by another man, from whom, as yet no registers have been received in my office. This observatory has been under the Meteorological Reporter to the Government of Madras.

The Seychelles observatory was equipped in 1882, but the first registers contributed were those for June 1883, since which they have been received regularly up to January 1884. They appear to be fairly good as far as they go, but many important observations are deficient. As the Meteorological Officer of the Mauritius Government has also an observer here, it is desirable, if possible, that the two Departments should co-operate, and I have had some correspondence with Mr. Meldrum, the Meteorological Officer of the Mauritius, on this subject. There is much difficulty in controlling these remote observatories, as there is, as a rule, no one on the spot, having any technical knowledge of meteorology, and the observers are necessarily left to the guidance of their own intelligence with such assistance as they can obtain from the printed instructions.

FIRST CLASS OBSERVATORIES IN INDIA.—It was proposed as a part of the scheme of re-organisation sanctioned by Government in 1875, that in addition to the then existing first class observatory at Bombay, observatories furnished with autographic instruments should be established at Calcutta, Allahabad, and Lahore. The first of these was provided under the Lieutenant-Governorship of Sir G. Campbell, who erected a suitable building for the purpose at Alipore, and this has now been working steadily and with satisfactory results since the spring of 1877. Owing to the want of buildings in any suitable site, the provision of similar observatories at Allahabad and Lahore has hitherto remained in abeyance, and, in fact, as regards suitability of site, the existing observatories at both these seats of Government are far inferior to those at the large majority of the minor stations.

It is therefore with much satisfaction that I am able to report that at Lahore there is, at length, a prospect of a suitable building being shortly placed at the disposal of the Department. Shortly after the close of the official year, I visited Lahore, chiefly with a view to this object, and I there learned that a building, the property of Government, situated in a very excellent site, would shortly be vacated, and might probably be made available as an observatory and office for the Meteorological Reporter. This proposal has received the approval of the Lieutenant-Governor of the Punjab, and the building in question will be made over to the Meteorological Department in July, when steps will be taken, with as little delay as possible, to carry out the original scheme.

---

[1] On the 1st September 1883.

[2] I regret to report that, no reply having been received from the Home Government, and the services of the observer being urgently required by the Medical Department, it has been necessary to close the observatory.

In the case of Allahabad, a suitable site has been obtained in the Chatham lines, and although, owing to financial considerations, it has been found necessary yet again to defer the erection of the permanent building, it is proposed to erect a temporary observatory on the spot, and commence observations for the purpose of determining the extent to which the proposed change of site will influence the normal values of the observations, especially as regards temperature and humidity. I would fain hope that this preliminary measure may be carried into effect at an early date. Every delay increases the risk of losing a sufficiently long comparative record ; in which case, much of the utility of the registers of the present observatory, now extending over nine years, will be lost to science.

REGISTRATION OF RAINFALL.—In former reports, I have given an account of the steps taken to obtain registers of rainfall from those portions of India which, up to 1881, were entirely unrepresented in the records of the Department. There were then two extensive tracts, one in the peninsular and the other in North-Western India, the rainfall of any portion of which could only be vaguely inferred from that of the surrounding regions. The first of these was the comparatively wild and inaccessible country, lying between the Central Provinces on the one hand and Chutia Nagpur, Orissa, and the Northern Circars on the other, and comprising an area of about 150,000 square miles. The other was the desert region of Western Rajputana with the Native States of Khyrpore and Bahawalpore, measuring approximately 65,000 square miles. In former reports, I have recounted the steps taken to establish raingauges in South Rewah, Sirgujah, the Tributary Mehals, the eastern districts of the Central Provinces, Bastar, Jeypore, and the zemindaries of the Northern Circars, all included in the former tract. This is now represented by the following stations :—

Chandia	in South Rewah.
Sohagpur	,, ,,
Dudhi	,, Mirzapur.
Palamow	,, Chutia Nagpur.
Lohardugga	,, ,,
Sirgujah	,, Sirgujah.
Jushpore	,, the Tributary Mehals.
Gangpur	,, ,,
Keonjhour	,, ,,
Talchir	,, ,,
Angul	,, ,,
Denkanal	,, ,,
Bispara	,, ,,
Kunjabangar	in the Tributary Mehals.
Saragaon	,, the Central Provinces.
Raigarh	,, ,,
Sarangarh	,, ,,
Dhamtari	,, ,,
Bastar	,, Bastar.
Naurangapur	,, Jeypore.
Kotipad	,, ,,
Koraput	,, ,,
Malkanagiri	,, ,,
Gunipur	,, the Northern Circars.
Rayaghadda	,, ,,
Narsapatam	,, ,,

In Western Rajputana, a thinly-peopled tract of very light and precarious rainfall, raingauges have now been established at the following stations ; at all but Bickaneer and Pachbadra, within the last year :—

Bickaneer.
Jasol.
Pali.
Nagar.
Jessulmere.
Barmer.
Pachbadra.

In some parts of Bengal and of the Madras Presidency, where the raingauge stations sending registers to the Central Office were somewhat thinly scattered, and insufficient fairly to represent the average rainfall of the tracts in question, some additions have been made to the list, by selections from the sub-divisional stations already provided with gauges, and nearly the whole of India is now fairly well represented in the published returns.

CHART OF AVERAGE RAINFALL OF INDIA.—In last year's report, I described the chart of the average rainfall of India which had been prepared in the office and was then in the lithographer's hands. It was completed and printed in colours by December 1883, and the first copies were exhibited at the Calcutta Exhibition. Judging from the requisitions that have been received for copies of this chart, I believe that it has been found of much use by administrative officers and others.

Charts, on a smaller scale, have been prepared showing the average distribution of the rainfall in the principal seasons of the year, *viz.*, the cold season (November to February), the hot season (March to May), and the rains, but these have not as yet been lithographed.

SEISMIC OBSERVATORIES.—The registration of earthquake phenomena is a branch of terrestrial physics, but remotely connected with meteorology; but, inasmuch as it requires for its prosecution the establishment of fixed observatories, it has been found convenient to utilize certain of the existing meteorological observatories for the purpose. In 1882, in consequence of a representation from the Superintendent of the Geological Survey, a sum of Rs. 2,000 was allotted for providing a simple form of seismic apparatus and sheds for its protection, the arrangements being entrusted to the Superintendent of the Geological Survey in conjunction with myself. The iron sheds proving more costly than had been originally anticipated, the number of proposed observatories had to be reduced to three, only one of which is provided with the full set of apparatus, and the stations of Silchar, Sibsagar, and Shillong were selected for the purpose. The apparatus consisting of Mallet's cylinders and post (with bronze spheres) was constructed at the Mathematical Instrument Department. Working drawings of the shed were prepared and forwarded to the stations in question, and during the last cold weather the sheds were constructed and the apparatus set up.

When on my recent tour of inspection, I found the arrangements completed at Shillong and Silchar, and I determined the azimuths of these two observatories. That of Sibsagar was incomplete; the meridian line was however fixed, and the verification of the azimuth must be made on the next occasion of visiting the observatory.

The registers are transmitted to the Superintendent of the Geological Survey.

INSPECTION OF OBSERVATORIES.—The inspection of observatories has been adverted to, in previous reports, as one of the most important duties of the Meteorological Reporters. Thirty-three observatories have been inspected during the year by one or another of these officers, and seven by the Sanitary Commissioners of the Central Provinces and British Burmah,[1] but in the case of most of the Reporters, indeed all those who hold other offices in addition to their Reporterships, the occasions on which they are able to absent themselves from head-quarters in the performance of this duty are rare, and thus it frequently happens that observatories, the work of which is far from satisfactory and which urgently require inspection, are left for months unvisited, owing to the inability of the local Reporter to leave his local office. In the case of stations not accessible by rail, steamer, or horse dâk, such as those in Western Rajputana and some of those in the Central Provinces, the consumption of time in the mere performance of the journey to reach them is such as to be practically prohibitive of inspection; thus it happens that Raipur, Sambalpur, Pachbadra, Quetta, Leh, Mercara, Tounghoo, and some others have never yet been visited by any Meteorological Officer; and Bickaneer, Seoni, Chanda, Dera Ismail Khan, Sibsagar, and most of the Burmese observatories have been inspected but once during the many years of their establishment. Under these circumstances, some of the local Reporters, *viz.*, Dr. Neil and his successor, Dr. Lawrie, in the Punjab, Miss Pogson in Madras, and recently Mr. Eliot in Bengal, have endeavoured to utilize the services of their head clerks to carry out the needful inspection, furnishing them with such instructions as they deem necessary, and with the guidance of some practical experience of work in a local observatory and that of the official book of instructions. Mr. Eliot and Dr. Lawrie, in their reports, both speak very favourably of the result of this measure; and I have never doubted that, when intelligent men of this class, properly coached in their duties beforehand, are so employed, they may be very serviceable. Indeed it was in this conviction that I proposed, in 1881, to add a travelling instructor to the head office, whose duties would be very similar to those actually performed by the head clerks of the offices referred to.

---

[1] Exclusive of the five observatories at the Reporters' head-quarters.

But it must not be supposed that, by any such measure, the Reporters can be entirely relieved of the duty of inspecting their observatories. Where, as in the majority of cases, the shortcomings of observers are due to their neglect or misapprehension of the rules laid down for their guidance, and to their departure from the prescribed routine, an intelligent head clerk or chief observer is quite able to do all that is required. But the knowledge of these men is purely empirical; and when therefore the registers of an observatory are affected by some cause or condition, not specially noticed in the official instructions, and which it requires a trained judgment to detect and estimate, only an officer of scientific experience, and with a good practical knowledge of physics, can decide wherein the work of an observatory is at fault and how it may best be remedied. And there are certain portions of an inspector's routine work, which require more experience in the details of manipulation, than men ordinarily engaged in clerical duties can well perform—such as verifying thermometers and cleaning barometer cisterns, with such appliances only as are available at the observatories.

The conclusion that I draw is this. Reporters should visit every observatory in their province once at least, and as soon after their appointment as possible. They should also inspect them subsequently, from time to time, as far as may be practicable; and only in the event of their inability to visit a station which stands in urgent need of inspection, or when the difficulty to be met is believed to be such as a subordinate officer can cope with, should such an officer be employed on the duty.

BENGAL PROVINCIAL SYSTEM OF TELEGRAPHIC REPORT.—In the latter part of 1882, a scheme was drawn up by Mr. Eliot, at the instance of the Government of Bengal, for establishing a local system of daily telegraphic weather report during the rainy season. For the information of the Provincial Government and its administrative officers, it was desired to obtain more ample information of the current phases of the weather than is afforded by the 16 observatories which form part of the imperial system in that Province; and also to disseminate this information more rapidly and widely to the local officers, than is practicable from the Simla office. It was arranged that the additional expenditure to be incurred to the Meteorological Department should be met by an allotment of the provincial revenues, to be placed at the disposal of the Imperial Government; the general control being, like that of all other meteorological establishments, vested in the Reporter to the Government of India.

In Mr. Eliot's Administration Report (Appendix A), will be found a very full account of the measures adopted to give effect to this scheme, which came into operation, on the 15th May 1883. Twenty-two additional observatories were established in different parts of Bengal, making, together with the sixteen existing Imperial observatories, a total of 38 for the province. Of these, 31, which are in telegraphic communication with Calcutta (including the Alipore Observatory), transmit to the Bengal Office a daily telegram of the observations recorded at 10 A.M., from the 15th May to the 15th November; and these, after correction and reduction, are published daily in a tabular form, together with a general description of the weather phases of the day. The preparation of this report is completed and sent to the Bengal Secretariat Press by 4 P.M., where it is printed and distributed from the press in time for the outgoing evening mail.

In addition to the daily report of the general weather, Mr. Eliot publishes a weekly statement, giving the average and extreme variations of the meteorological elements for the week at all observatories, and the rainfall returns for the week, recorded at 166 stations. These latter are transmitted by post cards, despatched daily whenever rain is registered, and a weekly return is also forwarded as a check on the daily despatch. From a few remote stations the latter are transmitted by telegraph.

The working of the system is, therefore, accomplished with great fulness and despatch, and reflects very great credit on Mr. Eliot's administrative capacity and energy. The amount of additional personal work that it imposes on the Reporter to the Government of Bengal is very considerable, since all but the mechanical tabulation of the data falls upon him personally, and this both for the daily and weekly reports, and is an addition to the daily storm service reports, which are prepared and issued daily throughout the year. The personal work thus falling on Mr. Eliot is probably double that accomplished by any other local Reporters, not excluding those who have no other duties to discharge. And it is work of a most arduous and exacting kind. From April to November two reports have to be prepared and issued daily, without a single day's remission, and since Mr. Eliot has no assistant to relieve him of the duty, and it is carried on in an exhausting and trying climate, whether ill or well, he has still to carry through the work.

CALCUTTA EXHIBITION.—A small court in the Indian Annexe of the Calcutta International Exhibition was occupied by the Meteorological Department for the exhibition of a Van Rysselberghe meteorograph, instruments of various kinds for measuring the solar heat and the humidity of the atmosphere, and a series of meteorological charts, specially prepared for the exhibition, to illustrate the monthly variations of barometric pressure and winds of India, of temperature, and the distribution of cloud; also of the rainfall of Bengal in the rainy months, and that of the whole of India in the three principal seasons of the year and on the general average of the year; the last being the lithographed chart already referred to.

PART II.—OBSERVATORIES.

In the Report for 1882-83, I enumerated 126 observatories which contributed registers to the Meteorological Office up to the close of the year; of which number, thirteen were either independent or attached to Government Offices and not paid for by the Department, and six were private or foreign observatories. Excluding the 22 new observatories which have been established in Bengal as part of the provincial system, the only additions made during the past year are—

Kailang or Kyelang in Lahoul	(3rd class)
Seychelles Islands	(do.)

both of which had been furnished with instruments in the previous year. The first of these began to contribute registers in June 1883, the second in July 1883. Three other observatories, *viz.*, Cuddapah, and Rajahmundry in Madras, and Chamba in the N.-W. Himalaya, were furnished with instruments, but had not began to contribute registers before the end of the year.

The voluntary observatory at Paori in Kumaon having ceased to contribute registers since the 30th November 1883, the net addition to the list of observatories is one only, and at the end of the year the total number was 127. But 128 contributed registers during, at least, some part of the year. These were distributed as follow:—

Indian Empire.	
Bengal and Assam	22
North-Western Provinces and Oudh	18
Punjab	12
Central Provinces	11
Berar	5
Central India and Rajputana	10
Bombay	14
Madras, Mysore, Coorg and Hyderabad	17
British Burma	8
Bay Islands	2
Lakhadives	1
TOTAL .	120
Extra Indian Settlements and Foreign States.	
Nepal	1
Kashmir territories	1
Baluchistan	1
Goa	1
Persian Gulf	1
Aden	1
Zanzibar	1
Seychelles	1
TOTAL .	8
GRAND TOTAL .	128

Of the whole number, three are first class observatories with instruments registering autographically, twenty-six second class observatories, at all but two of which, in addition to observations at 10 hours and 16 hours daily, hourly readings are registered on four (or in some cases three) days in each month, and at all but one of these latter, synoptic observations are registered daily at 7 hours Washington mean time (=18 hours 1 minute Calcutta mean time). The remainder, with five exceptions, are third class stations, registering two full sets of observations; and, in the case of certain of the Madras stations, three sets daily. The five excepted stations, Chowringhee (Calcutta), Mongpoo, Tura, Demagiri, and Makhla, register only temperature, rainfall, and wind direction. The observatories may further be classed as—

	Class.			
	1st.	2nd.	3rd.	4th.
A.—Government observatories with paid observers under the Meteorological Department	1	25	82	1
B.—Independent observatories or attached to Government Offices, observers not paid by the Meteorological Department	1	0	7	4
C.—Private and foreign observatories	1	1	4	0
TOTAL	3	26	93	5

OBSERVATORIES IN BENGAL AND ASSAM.—*The Alipore Observatory.*—This observatory serves as a general depôt for the verification of instruments, as well as for observations of an experimental character, and an important part of the work is the working of the time signals for the port of Calcutta. It is immediately superintended by the Reporter to the Government of India, and the establishment is under the immediate charge of the Chief Observer, Babu Brojo Mohun Rukhit, B.A. During the past year, the work of the observatory has consisted of—

1st.—Continuous registration, by autographic instruments of (*a*) the duration of bright sunshine, (*b*) the atmospheric pressure, (*c*) temperature, (*d*) moisture (dry and wet bulb thermometers), (*e*) wind direction, movement and pressure, and (*f*) rainfall.

2nd.—Periodical readings, four times daily, of the barometer, dry and wet bulb thermometers, and estimates of cloud proportion; once daily of the maximum and minimum thermometers in shade, those of the exposed thermometers for nocturnal radiation and insolation; and thrice daily those of the ground thermometers at the surface, 1 foot, 3 feet, and 6 feet deep. Also occasional observations on the movements of the higher clouds by means of the nephescope.

3rd.—The verification of all thermometers issued to observatories throughout India, with the exception of those under the Meteorological Reporter for Western India; and the comparison of all barometers with the Calcutta standard.

4th.—The determination of the mean local time, by meridian observations of the sun, and the working of the time signals for the guidance of the shipping in the port. Also the custody and rating of Government chronometers.

The actinometric observations, with a Stewart's actinometer, were discontinued in February 1883, as reported at page 20 of the Report for 1882-83.

The establishment for the above purposes consists of—

Babu Brojo Mohun Rakhit, B.A.	Chief Observer.
„ Khetra Mohun Mukerjee* „ Annoda Prosaud Banerjee†	1st Photo. Asst.
„ Annoda Prosaud Banerjee* „ Ram Chunder Chuckerbutty‡	2nd Ditto.

---

* Up to 5th May 1883. † From 6th May 1883. ‡ From 1st June 1883.

Babu Mohendra Nath Banerjee	Observer.
,, Shyam Lall Sen	Ditto.

2 Artificers.
1 Batteryman.
6 Servants.

The autographic instruments consist of a sunshine recorder, the Kew barograph and thermograph, which register by photography, a Beckley's anemograph, an Osler's anemometer, and a Beckley's rain gauge. During the past year all these instruments have worked fairly well. There were, indeed, several temporary interruptions in the action of the photographic instruments, owing either to the stopping of the driving clocks, the failure of the illuminating arrangements, and, in the case of the thermograph, either to the trace running beyond the illuminated zone, when the range of temperature was very great in the hot weather, or to the drying of the muslin in the covered bulb when the evaporation was very rapid in the hot weather. All these are failures that may be avoided by proper attention, and having impressed on the chief observer the discredit that attaches to such imperfect work, I am glad to report that by increased attention to the instruments, he has succeeded, during the past month of May, in producing continuous and unbroken traces.

The following table gives a comparative view of the mean results of the autographic registers of the barograph and thermograph, and of the eye-readings of the standard barometer and shaded thermometers, recorded at the same hours. The standard barometer has the cistern about one foot higher than the barograph, and the standard thermometers are exposed under a shed open all round, while the bulbs of the thermograph are under a louvred penthouse against the north wall of the observatory :—

Comparative mean reduced readings of barograph and standard barometer in 1883.

1883.	STANDARD BAROMKTER.					BAROGRAPH.				
	6 hours.	10 hours.	16 hours.	22 hours.	Mean.	6 hours.	10 hours.	16 hours.	22 hours.	Mean.
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
January	30·046	30·110	29·981	30·045	30·046	30·025	30·101	29·972	30·041	30·035
February	29·964	·040	·904	29·975	29·971	29·954	·036	·901	29·974	29·966
March	·857	29·924	·790	·864	·859	·853	29·923	·790	·864	·858
April	·740	·792	·660	·744	·734	·731	·790	·657	·741	·730
May	·618	·666	·548	·632	·616	·613	·666	·545	·634	·615
June	·532	·566	·469	·552	·530	·524	·564	·463	·547	·525
July	·523	·557	·462	·547	·522	·515	·564	·465	·548	·523
August	·597	·641	·544	·629	·603	·584	·625	·528	·614	·588
September	·671	·723	·618	·707	·680	·670	·726	·617	·704	·679
October	·893	·936	·826	·893	·887	·887	·936	·822	·891	·884
November	·930	·982	·861	·935	·927	·924	·979	·858	·929	·923
December	30·062	30·128	30·007	30·076	30·068	30·051	30·121	30·001	30·071	30·061
Year	29·786	29·839	29·723	29·800	29·787	29·778	29·836	29·718	29·797	29·782

Comparative mean readings of the thermograph and dry bulb thermometer in the thermometer shed, in 1883.

1883.	Thermometer in shed.					Thermograph (dry bulb).				
	6 hours.	10 hours.	16 hours.	22 hours.	Mean.	6 hours.	10 hours.	16 hours.	22 hours.	Mean.
	°	°	°	°	°	°	°	°	°	°
January . . .	54·9	68·3	74·9	60·0	64·5	56·3	67·0	73·6	60·7	64·4
February . . .	59·4	70·7	77·8	63·7	67·9	60·4	69·7	76·5	64·6	67·8
March . . .	69·8	80·5	87·4	75·0	78·2	70·9	79·9	86·8	75·3	78·2
April	76·1	87·0	91·5	79·6	83·6	77·4	87·0	92·0	79·9	84·1
May	80·1	88·7	91·0	82·6	85·6	81·0	89·4	91·7	83·4	86·4
June	79·8	86·2	86·8	81·1	83·5	80·7	87·1	87·4	81·7	84·2
July	79·4	84·1	84·7	80·7	82·2	80·1	84·8	85·6	81·4	83·0
August . . .	79·1	84·0	83·6	80·5	81·8	79·8	84·6	84·5	81·1	82·5
September . . .	79·1	84·2	84·6	80·5	82·1	79·7	84·7	85·5	81·1	82·8
October . . .	74·3	83·4	85·9	77·2	80·2	75·2	82·9	85·8	77·9	80·5
November . . .	61·9	74·8	79·4	65·4	70·4	62·9	73·7	78·5	66·2	70·3
December . . .	54·9	65·7	71·9	58·3	62·7	56·1	64·8	70·9	59·2	62·8
Year . .	70·7	79·8	83·3	73·7	76·9	71·7	79·6	83·2	74·4	77·3

Comparative mean readings of the thermograph and wet bulb thermometer in the thermometer shed in 1883.

1883.	Wet bulb in shed.					Thermograph (wet bulb).				
	6 hours.	10 hours.	16 hours.	22 hours.	Mean.	6 hours.	10 hours.	16 hours.	22 hours.	Mean.
	°	°	°	°	°	°	°	°	°	°
January . . .	53·9	60·3	61·4	57·5	58·3	54·2	59·5	61·3	57·6	58·2
February . . .	57·2	61·1	62·4	60·2	60·2	57·6	60·8	62·6	60·6	60·4
March	68·0	71·1	70·4	71·5	70·3	68·5	71·4	71·2	71·0	70·5
April	74·7	80·3	81·1	76·1	78·1	74·9	78·7	78·4	75·7	76·9
May	77·9	80·6	80·6	78·5	79·4	78·3	81·6	81·7	78·8	80·1
June	78·1	80·3	80·1	78·0	79·1	79·0	81·1	80·8	78·7	79·9
July	77·9	79·9	80·1	78·7	79·2	78·5	80·4	80·9	79·2	79·8
August . . .	77·7	79·5	79·5	78·3	78·8	78·1	80·2	80·3	78·7	79·3
September . . .	77·9	79·5	79·6	78·6	78·9	78·3	80·2	80·4	79·0	79·5
October . . .	72·7	75·6	75·5	74·4	74·6	73·3	75·7	76·1	75·2	75·1
November . . .	59·2	64·5	65·1	62·1	62·7	60·3	64·5	65·8	62·9	63·4
December . . .	52·9	58·2	60·3	56·2	56·9	54·0	57·9	60·0	56·4	57·1
Year . .	69·0	72·6	73·0	70·8	71·4	69·6	72·7	73·3	71·2	71·7

The sunshine recorder has been in constant use throughout the year, being placed on the top of the transit room building, in order to secure an unobstructed range of sky exposure. The instrument is shaded by some distant trees for about quarter hour after sunrise and before sunset, but this is unavoidable. It is, however, of little importance, as, in the atmosphere of Calcutta, the rays that would reach the instrument during these intervals have but little heating power.

The observations of ground temperature have been steadily continued, the thermometers being read three times daily at intervals of eight hours. It has been mentioned in previous reports, that the temperature shown by the thermometer at 1 foot appeared anomalously low as compared with that of the surface on the one hand, and that of the 3 feet thermometer on the other. As a reverification of the instruments convinced me that the fault was not in the thermometer, I thought it probable that it might be due to convection within the wooden tube in which it was placed, and which left a considerable air space around the wooden block on which the instrument is mounted. To test this view, I had a second tube constructed of smaller diameter, so that by winding a strip of flannel around the instrument it nearly fitted the tube and prevented convection. This was buried side by side with the former tube, the thermometer bulb being at the same depth; and a comparison of the results, which have now been recorded more than a twelve month, has gone far to confirm my surmise. On the average of the year, the early morning reading of the new thermometer is 0·5° and the evening reading 0·3° in excess of that of the old thermometer, whereas the noon reading is 0·1° lower, indicating that, in the wide tube, the night temperature is considerably affected by the convective descent of cooled air from the upper and exposed end of the tube. This is not compensated by convection of the more heated air in the day time, as the latter, being lighter, tends to remain at the upper end of the tube.

One month before the close of the year under report, a thermometer was installed at a depth of 6 feet from the surface, the tube in this case being closed below by a copper plate, with a view to keeping out water in the rains. This is read once daily. The following table gives the mean monthly readings of all these thermometers:—

Mean temperature of ground at Alipore in 1883-84.

MONTHS.	SURFACE.			1 FOOT DEEP (OLD).			1 FOOT DEEP (NEW).			3 FEET DEEP.			6 FEET DEEP.	MEANS.				
	5¾ hours.	13¾ hours.	21¾ hours.	5¾ hours.	13¾ hours.	21¾ hours.	5¾ hours.	13¾ hours.	21¾ hours.	5¾ hours.	13¾ hours.	21¾ hours.	13¾ hours.	Air in shade.	Surface.	1 foot deep (old).	1 foot deep (new).	3 feet deep.
April 1883 .	79·0	109·9	82·9	85·0	85·4	86·5	86·1	85·5	87·4	83·7	83·9	83·9	...	83·8	90·6	85·6	86·3	83·8
May „ .	82·9	110·9	86·1	88·7	89·0	90·4	89·4	89·1	91·4	87·0	87·1	87·1	...	86·1	93·3	89·4	90·0	87·1
June „ .	82·2	97·0	83·8	87·3	87·5	88·2	87·7	87·4	88·7	87·8	87·7	87·7	...	83·9	87·7	87·7	87·9	87·7
July „ .	81·5	95·0	83·4	86·0	85·9	86·4	86·1	85·6	86·6	86·2	86·3	86·3	...	82·8	86·6	86·1	86·1	86·3
August „ .	81·8	94·7	84·0	85·9	85·8	86·2	86·0	85·6	86·5	86·3	86·3	86·3	...	82·4	86·8	86·0	86·0	86·3
September „ .	81·4	96·6	83·3	86·2	86·2	86·7	86·3	85·9	86·8	86·6	86·5	86·6	...	82·7	87·1	86·4	86·3	86·6
October „ .	76·1	96·0	78·9	83·8	83·9	84·2	84·0	83·6	84·4	85·7	85·8	85·8	...	80·1	83·7	84·0	84·0	85·8
November „ .	62·3	83·3	65·6	74·7	75·0	75·3	75·4	75·0	75·9	79·9	80·7	80·5	...	69·8	70·4	75·0	75·4	80·4
December „ .	55·4	72·0	58·9	66·1	66·4	66·8	66·9	66·3	67·2	73·1	73·6	73·4	...	62·4	62·1	66·4	66·8	73·4
January 1884 .	56·1	73·9	59·9	66·3	66·4	67·2	66·8	66·1	67·3	70·2	70·7	70·7	...	64·1	63·3	66·6	66·7	70·5
February „ .	61·0	84·0	64·5	70·1	70·3	71·3	70·8	70·1	71·5	72·5	72·8	72·9	...	68·6	69·8	70·6	70·8	72·7
March „ .	73·3	100·8	77·6	81·1	81·1	82·4	81·4	80·7	82·3	79·6	79·7	79·8	77·7	81·2	83·9	81·5	81·5	79·7
Means .	72·8	92·8	75·7	80·1	80·2	81·0	80·6	80·1	81·3	81·6	81·8	81·8	...	77·3	80·4	80·4	80·7	81·7

The hourly readings of the surface, 1 foot and 3 feet thermometers, recorded for one month, in each of the three principal seasons (the cold season, hot season, and the rains) in 1881 and 1882, show that there is no appreciable difference between the means of the three daily readings and the true daily means of any of the three thermometers, and, therefore, the former may be accepted as valid representatives of the latter. These exhibit the same features as those of previous years, the anomalous depression of the old 1 foot thermometer above noticed being due to foreign causes. The temperature at 3 feet is, on the average of the year, 1·3° higher than that of the ground surface, and 4·4° higher than that of the air. The temperature, shown by the new 1 foot thermometer, is 0·3° higher than that of the surface, and 1° lower than that at 3 feet, therefore intermediate, and implying a rapid downward increase of temperature, which yet remains for explanation.

The number of instruments verified at the Alipore observatory, during the year ending 31st March, 1884, is as follows :—

Instruments.	No.
1. Barometers	58
2. Aneroids	6
3. Dry and wet bulb thermometers	87
4. Maximum thermometers for air temperatures	42
5. Minimum do. do. do.	61
6. Do. do. for nocturnal radiation	14
7. Solar radiation do.	16
8. Standard do.	2
9. Common do.	8
10. Sand glasses	80
TOTAL	374

and the following is a return of those received and issued by the Observatory Store Department :—

Instruments.	Received.	Issued.
1. Barometers	47	64
2. Aneroids	6	7
3. Dry and wet bulb thermometers	58	86
4. Maximum thermometers for air temperatures	21	57
5. Minimum do. do. do.	49	59
6. Do. do. for nocturnal radiation	25	31
7. Standard do.	3	4
8. Solar radiation do.	32	14
9. Common do.	8	8
10. Anemometers	1	20
11. Anemoscopes	0	8
12. Six's thermometers	6	0
13. Frankland's solar radiation thermometers	6	1
14. Sand glasses	80	78
TOTAL	342	437

The receipts and issues are considerably more than double the corresponding numbers for the previous year, which is mainly due to the requirements of the twenty-two new observatories established in Bengal for the purposes of the local system.

The time signals have worked in a far more satisfactory manner than in any previous year. Two time balls are dropped from the Alipore observatory, the one on the Semaphore Tower in Fort William, the other on the Port Commissioners' office on the Strand. The latter of these was under repair, and therefore out of work for 22 days. It dropped correctly on 264 days and failed on 1 only. The former was dropped correctly on 285 days and failed on 3 days, as shown in the tabular statement below.

A signal was given by either one or the other ball on 288 days, the remaining 78 days being either Sundays or public holidays.

Table showing the failures of the two time balls during the official year 1883-84.

Dates of failures.	Nature of failure.
5th June	Time ball on the Semaphore Tower, Fort William, failed altogether.
28th July	Time ball at the Port Commissioners' Office failed altogether.
3rd September . . .	Time ball on the Semaphore Tower, Fort William, dropped a few seconds after 1 P. M.
14th September . . .	Time ball on the Semaphore Tower, Fort William, failed altogether.

OTHER OBSERVATORIES IN BENGAL AND ASSAM.—The twenty-two new observatories, which have been established in Bengal for the purposes of the local system of daily weather reports, furnish only one set of observations daily, and are not at present included in the imperial system. These are enumerated in the note below.[1] Excluding these, there are in Bengal and Assam 21 observatories, in addition to that of Alipore, and these are classified as follows:—

Second Class.

Sibsagar.
Dhubri.
Bankipore (Patna).
Hazaribagh.
Saugor Island.
Cuttack.
Chittagong.

Third Class.

Darjeeling (St. Paul's School).
Purneah
Durbhanga.
Gya.
Berhampore.
Burdwan.
Jessore.
Dacca.
Silchar.
False Point.

Fourth Class.

Calcutta (Chowringhee).
Demagiri.
Tura.
Mongpo.

---

[1] The observatories established for the system of daily local report in Bengal are the following:—

Balasore.
Midnapore.
Ranigunge.
Noakhally.
Burrisaul.
Serajgunge.
Commillah.
Furreedpore.
Mymensingh,
Rampore Beauleh.
Dinajpore.
Rungpore.
Julpigoree.
Bhagulpore.
Chupra.
Motihari.
Buxar.
Arrah.
Dehree.
Nya Doomka.
Ranchi.
Chyebassa.

In Mr. Eliot's Report (Appendix A), are given the names of the superintendents and observers at all the second and third class stations, and at Demagiri and Tura. The Chowringhee observatory is attached to the Meteorological Office, the clerks of which record the observations, and Mongpo is included in the list of those which report direct to the Office of the Reporter General (Appendix E). Of the second class observatories, Mr. Eliot has inspected Sibsagar, Dhubri, and Bankipore, and I accompanied him on his visits to the two first stations, partly with a view to gaining some personal acquaintance with the physiography of Assam, which is peculiar, and a knowledge of which is requisite to the understanding of certain peculiarities in the local meteorology. Both the Assam observatories were found to be in a condition very creditable to the observers; the more creditable in the case of Sibsagar, that this observatory has never been visited previously by any Meteorological Officer. Certain of the arrangements were susceptible of some improvement, but these were such as could only be judged of by an expert. The barometer cistern was cleaned, and the thermometers reverified by comparison with a portable standard, and found to be virtually unchanged. Some further details of the results of the inspection are given in Mr. Eliot's Report.

The Bankipore (Patna) observatory, visited by Mr. Eliot alone, is also reported to be satisfactory.

Of the third class observatories, Silchar was inspected by myself, Darjeeling, Jessore, Gya, and Durbhanga by Mr. Eliot, and Dacca by the head clerk of the Bengal Meteorological Office. The Silchar observatory was more satisfactory than it had been found to be on previous occasions of its inspection, and the faults observed, such as the too great size and faulty construction of the thermometer shed, and the ricketty and unsafe condition of the anemometer and wind vane posts, are hardly chargeable on the observer. He did not indeed set his barometer very accurately, but this was partly due to the oxidized condition of the mercury in the cistern. With the exception of one of the minimum thermometers, the instruments were in good condition. The barometer and thermometers were reverified.

Silchar is the only observatory that has been supplied with the full set of seismic instruments, as noticed in the first part of this report. These had just been set up at the time of my visit, and I was therefore enabled to ascertain the exact azimuth of the observatory, and to give the observer some instruction in the use of the apparatus.

Gya and Durbhanga are unfavourably reported on, and do not furnish observations that can be accepted as trustworthy. The observations do not harmonise with those of other stations around, and it is scarcely open to doubt that the discrepancies are due to ignorance or carelessness.

Dacca has been visited by the head clerk of the Bengal Office, and its condition is not favourably reported on, several of the instruments being in a very dirty condition.

The return of instruments, broken or injured, at the observatories of Bengal, given later on in this report, speaks favourably for the general carefulness of the observers.

Self-recording anemographs are at work at Darjeeling, Dhubri, Hazaribagh, Chittagong, Saugor Island, and Cuttack, as well as at the Alipore observatory. As in previous years, the Beckley's anemographs in use at Alipore, Saugor Island, and Chittagong are far more satisfactory in their working than the Casella's anemographs at the other stations.

The following observers have been awarded special allowances during the current year, the name marked* being that of an observer now placed on the list for the first time and† indicating that the allowance has been raised from Rs. 5 to Rs. 10.

Names.	Stations.	Amounts. Rs.
Makhadaprosad Chowdhry	Burdwan	10
Mahendranath Roy	Berhampore	10
† Dandadhar Datta Barua	Sibsagar	10
Maniruddeen Ahmed	Dhubri	10
J. Alley	Cuttack	5
* Nathoo Lall	Hazareebagh	5

That allotted last year to Jogin Chunder Banerjee, the observer of Durbhanga, has been withdrawn.

One object of my visit to Assam was to decide on the site of the new observatory which has been sanctioned for the Assam Valley. The station of Gauhati had been originally proposed for the purpose, but was unfavourably reported on by the local officer, as being surrounded by hills. This objection proving to be well founded, Tezpur was proposed as the alternative, and an inspection of this station having proved that it is well fitted for the purpose, a site was selected on the summit of a small hill overlooking the river Brahmaputra.

I also visited Shillong, partly to inspect the seismic apparatus lately set up there, and partly to see how far it would be practicable to establish an electrical wind vane and anemometer on the summit of the Shillong ridge, to register the direction and movement of the wind across the highest part of the Khasi hills, and transmit their indications to an observatory which I propose to establish in Shillong. I find that this can be done by telegraph wires about two miles in length, and as the register will be one of very great importance, I only await the receipt of the instruments ordered some time since from England, to take further steps for establishing this observatory.

OBSERVATORIES IN THE NORTH-WESTERN PROVINCES AND OUDH.—Except that the observatory, established on the voluntary system at Pauri, ceased to contribute registers after November 1883, the observatories in these provinces were the same as in the previous year, *viz.* :—

Second Class.

Allahabad.
Agra
Lucknow.
Roorkee.

Third Class.

Chakrata.
Ranikhet.
Mussooree (St. Fidelis).
Mussooree (S. G. Office).
Dehra (S. G. Office).
Dehra (Forest School).
Bareilly.
Meerut.
Gorakhpur.
Ghazipur.
Benares.
Jhansi.
Pauri.
Pithoragarh.

Dr. Murray Thomson's report (Appendix B) gives the names of the superintendents and observers at all except the Mussooree observatories and the Forest School at Dehra. Also the results of his inspection of Roorkee, Chakrata, and Meerut (the only observatories inspected), and of an unofficial visit to Lucknow and the St. Fidelis's observatory. The Allahabad observatory, being attached to the Reporter's Office, is constantly under his eye.

In consequence of the final determination of the North-Western Provinces Government, not to establish the future 1st class observatory in connection with the Muir College, Allahabad, the comparative observations of temperature and humidity that have been carried on on that site, for the last two years, were discontinued at the end of the year under report, and the instruments have been withdrawn. The results of the two years observations are noticed in the report (Appendix B), from which it appears that the mean temperature of the College site is nearly 1° higher than that of the present observatory, and the diurnal range of temperature greater; except in the spring months, March to May. These differences are greatest in October. They confirm the conclusion drawn from the results of the Chowringhee and Alipore observatories in Calcutta, *viz.*, that whatever care be taken to render the exposure of the instruments uniform, a mere change of the site of an observatory, from one part to another of the same station, induces such a change in the average indications of the instruments, that no comparison of any value can be made between the registers, unless, by means of simultaneous registration, the effects of the change of site have been ascertained and can be eliminated.

The work of the Agra observer is unfavourably reported on, and that of the voluntary observer at St. Fidelis's School, Mussooree, still more so. As little control can be exercised over observers whose work is unremunerated, it is under consideration whether it will be better to place the observatory on the usual footing of a Government observatory and to pay the observer, on the condition of his furnishing trustworthy work, or to withdraw the instruments and close the observatory. Enquiries are being made with a view to the decision. With one temporary exception, the other observatories in the province are satisfactory.

Special allowances have been awarded for the current year to the following observers:—

Names.	Stations.	Amounts. R
Chotay Lall	Lucknow	10
Kadernath Chatterjee	Allahabad	10
Jewa Nand	Ranikhet	10
Mir Altaf Ali	Agra	5
Saligram	Chakrata	5
Chirungi Lall	Roorkee	5
Devakinandan Pathak	Benares	5

The list of recipients is the same as that for the previous year.

OBSERVATORIES IN THE PUNJAB.—An additional observatory has been established in this province, *viz.*, in the Himalayan district of Kulu, at Kailang in the Chandra Bhaga valley, at an elevation of 10,000 feet above the sea-level, and the following is a complete list of the observatories of the province (not including Kashmir).

Second Class.

Lahore.

Third Class.

Mooltan.
Dera Ismail Khan.
Peshawar.
Rawalpindi.
Murree.
Sialkot.
Ludhiana.
Simla.
Kailang.
Delhi.
Sirsa.

Kailang having been established with the special object of contributing current information on the meteorology of the mountain zone, and especially of the snowfall, reports immediately to the general office for India; the remaining stations to the Meteorological Reporter to the Punjab Government. The names of the superintendents and observers at these latter are given in Dr. Lawrie's Report (Appendix C). Those of the Kailang observatory in Appendix E.

The observatories of Ludhiana, Simla, Delhi, and Sialkot were inspected by Dr. Lawrie, and those of Rawalpindi and Murree by myself shortly after the close of the year. The former are stated to have been found in excellent order, and the general work of the observatories to be very satisfactory. The observatory of Rawalpindi was for some years the most unsatisfactory in the province, the barometric observations, more particularly, being quite untrustworthy. Since the appointment of the present observer in November 1882, there has been a very great improvement, and during the past year, the Rawalpindi registers have been quite equal to the majority of those furnished by stations of the same class. I found the instruments in a very satisfactory condition as far as this depended on the observer, and as he could not have had any previous notice of my proposed visit, I do not doubt that such is their ordinary state.

The Murree observatory has always been favourably reported on, and its work is excellent. Indeed, the object of my visit was rather to gain an acquaintance with the position of the observatory and the local circumstances affecting the instruments than because an inspection was particularly needed. I availed myself of the opportunity to clean the barometer cisterns, both of the Rawalpindi and Murree instruments, both of which had become somewhat deteriorated with long use. Subsequently, I visited the Lahore observatory and cleaned the barometer there also.

The Lahore observatory is still at the Mayo Hospital, but its removal is urgently desired by the medical authorities; and however objectionable, as a rule, is the removal of an observatory from a site it has long occupied, in the present case it is desirable owing to the unsuitable circumstances of the present situation. But it is extremely important that the removal be made once for all, and that the future site be one that may be regarded as permanent. The chief object of my visit to Lahore was to see if this could be arranged, and I have given the results of my enquiry in the first part of this report.

The following is the list of the observers to whom special allowances have been awarded during the current year :—

Names.	Stations.	Amounts. R
Jaspat Rai	Lahore	5
Devan Chand	„	5
Fazul Rahman	Sirsa	5
W. Cruikshank	Murree	5
Khasi Ram	Pashawar	5
Wahid Ali	Mooltan	5

OBSERVATORIES IN THE CENTRAL PROVINCES.—As in previous years, these are eleven in number, *viz.*:—

Second Class.

Nagpur.
Jubbulpore.
Pachmarhi.

Third Class.

Saugor.
Hoshangabad.
Seoni.
Khandwa.
Chanda.
Sironcha.
Raipur.
Sambalpur.

The names of the superintendents and observers are given in Appendix D. The Sanitary Commissioner to the Government of the Central Provinces, who exercises the local administration of the observatories, reports favourably of the observers, with the exception of the Saugor observer, Tado Rao, who absconded in March, leaving the work of the observatory for a few days in abeyance. A new barometer room has been provided at the Khandwa observatory and the barometer was moved into it on the 1st July; and at Sambalpur the observatory has been moved to a new site, the barometric observations being however still carried on at the former site for the purpose of ascertaining the amount of change in the normal values that are the consequence of the removal.

The Sanitary Commissioner has inspected the Seoni observatory and found everything in good order.

The following observers have been selected for special allowances during the current year, the sign * indicating that the present is the first time of award:—

Names.	Stations.	Amounts. R
T. V. Allaghiri Swami	Nagpur	10
Jadunath Bose	Hoshangabad	5
Shamsoonder Dass	Sambalpur	5
Krishna Rao *	Raipur	5
Seetaram	Chanda	5
Pancham	Seoni	5

OBSERVATORIES IN BERAR.—As in the previous years, there were five of these observatories, *viz.*, four of the third and one of the fourth class; the last established by the Forest Department, and worked without charge to the Meteorological Department, except for the supply of instruments.

Third Class.

Akola.
Buldana.
Chikalda.
Amraoti.

Fourth Class.

Makhla.

The names of the superintendents and observers of the first four are given in the return appended to Mr. Pearson's Report, Appendix F. Those of Makhla are given in Appendix E. The four third class observatories are under the general direction of the Sanitary Commissioner for Berar, conjointly with the Reporter for Western India, and transmit their registers to the Bombay Meteorological Office.

No special mention is made of the work of these observatories in Mr. Pearson's report, and it does not appear that they have been inspected by the Reporter during the past year. The barometric registers of Chikalda and Buldana no longer show the discrepancies noticed in the previous year, and, as far as can be judged, the work of all these observatories appears to be satisfactory.

The following observers have had special allowances granted to them for the current year, that newly awarded being indicated by an *:—

Names.	Stations.	Amount. Rs.
Samuel Gregory	Akola	10
Bukaram Pandurang	Amraoti	5
Hira Lall *	Chikalda	5

Observatories in Central India and Rajputana.—The number of these observatories also, is the same as in the previous year. The list is as follows :—

First Class.

Jeypore.

Third Class.

Sutna.
Nowgong.
Neemuch.
Indore.
Mount Abu.
Pachbudra.
Ajmere.
Sambhar.
Bickaneer.

The Maharajah's observatory at Jeypore is independent of this Department, except that it sometimes receives assistance and information, and on the other hand furnishes full copies of the registers to this office. Dr. Owen, who during the past year has superintended the observatory, has furnished a brief report on its condition and working, which is appended to that of the Reporter to the Government of the North-Western Provinces (Appendix B II). A nephescope and sun-shine recorder have been added to the instruments recorded at the observatory, the latter having been in operation since the 1st February 1884. Dr. Owen notices some difficulties that have been met with in the working of the Van Rysselberghe meteorograph, and how they have been met and overcome.

Of the remaining observatories, Sutna, Nowgong, Ajmere, and Sambhar send their registers to the Meteorological Reporter for the North-Western Provinces and Oudh, and are under that officer's administration; those of Indore, Neemuch, Mount Abu, and Bickaneer report to the Meteorological Reporter for Western India, and Pachbudra to the Central Office in Calcutta. The names of the superintendents and observers will accordingly be found respectively in the lists (Appendices B III, F II and E). The first mentioned of these officers has not inspected any of the observatories during the past year, and no special mention is made of them in his report. Those of Mount Abu, Neemuch and Indore have been visited by Mr. Pearson, whose remarks on the results of his inspection will be found in Appendix F.

At Mount Abu, the barometer was out of order and untrustworthy, but this does not appear to be due to any negligence on the part of the observer. With one exception, which, however, does seem to imply neglect of the instructions, the other instruments were in good order. The observer's work is generally well reported of.

At Neemuch some faults are noticed in the arrangement and exposure of the instruments, and their condition was by no means satisfactory. In some other respects also, the observer's work is unfavourably noticed, and he is said to be deficient in intelligence. As a special allowance was awarded to him two years since on the recommendation of Mr. F. Chambers, it has not been withdrawn, but will be so unless his work during the present year shows very great improvement.

At Indore the instruments were in good order. The observer is said to be an intelligent man, but apparently somewhat careless.

There has been a considerable improvement in the work of the Pachbudra observatory, but the registers cannot as yet be called satisfactory. Special allowances have been awarded to the following observers during the current year :—

Names.	Stations.	Amounts. Rs.
Ram Lall †	Bickaneer	10
Har Nath	Sutna	5
Ram Prosad	Ajmere	5
T. Bachu	Neemuch	5

OBSERVATORIES IN THE BOMBAY PRESIDENCY.—These are fourteen in number, as in the previous years; the first class observatory of Colaba being under management independent of the Meteorological Department.

First Class.

Colaba (Bombay).

Second Class.

Belgaum.
Poona.
Deesa.
Kurrachee.

Third Class.

Jacobabad.
Hyderabad (Sind).
Bhuj.
Rajkot.
Sholapur.
Surat.
Malegaon.
Ratnagiri.
Karwar.

The names of the superintendents and observers are given in Appendix F II.

The four stations of the second class have all been inspected by Mr. Pearson during the year. At Kurrachee the instruments were found to be in good condition and call for no special remark. At Deesa the majority were in good order. Some of the mechanical arrangements of the observatory were defective, and Mr. Pearson reports that there had been some difficulty in obtaining an assistant observer, Deesa being nothing but a military camp and (the native inhabitants presumably) very backward in point of education. At Poona, with one exception, the instruments were in good condition, but the apparently ineradicable habit of observing time other than that of the station was still persevered in. The Casella anemograph is more favourably reported on than is the case at most stations.

At Belgaum everything was found to be on the whole satisfactory.

Of the third class stations, Jacobabad, Hyderabad, Bhuj, Surat, Malegaon, Ratnagiri, Sholapur, and Karwar were inspected during the year; all therefore with the exception of Rajkot. The results are given in detail in Mr. Pearson's Report (Appendix F). The observers of Hyderabad and Karwar are very favourably reported on. Those of other observatories fairly well more or less, with the exception of the man in charge of the anemometer at Hyderabad and the late observer at Malegaon, Solomon Aaron, whose work is stated to have been very defective. At Jacobabad the nocturnal radiation thermometer had been improperly exposed; at Bhuj the mercury of the barometer cistern was thickly encrusted with oxide, the thermometer had too large an opening for ventilation and the raingauge had been tarred; the anemometer post too was not easy to ascend. At Surat the wind observations were very roughly made and the observer's punctuality was doubtful. The anemometer also was out of order. At Malegaon the barometer was dirty but not otherwise out of order, and the apparently discrepant character of the observations during the past three or four years, to which the attention of the Reporter had been drawn, must therefore have been due to some fault of the observer. The anemometer was worn and worked stiffly. At Ratnagiri everything was in good order, except that the anemograph tower was not weather proof. At Sholapur the observatory is retained at its old side. It had been proposed to remove it to the Electric Telegraph Office, and arrangements were in progress for this purpose, but the step has been postponed, as it is doubtful whether the Electric Telegraph Office will long be retained at its present site. The barometric readings during a part of December were incorrect and had to be rejected. At Karwar every thing was in good condition; this has hitherto been a voluntary observatory, but application having lately been made for an allowance to the observer, and granted, it will henceforth rank on the regular list of Government observatories under the Department.

The following is the list of observers in the Bombay Presidency to whom special allowances have been awarded for the current year:—

Names.	Stations.	Amounts.
		Rs.
Mahadev Cuddum	Ratnagiri	5
Narayen Sakaram	Poona	5

OBSERVATORIES IN MADRAS, MYSORE, COORG, AND HYDERABAD.—Of the three additional observatories in Madras, sanctioned in October 1881, that of Kurnool was established in 1882, that of Cuddapah a few days before the close of the year under report, *viz.*, in March 1884, and the third only since its expiration. There were therefore eighteen observatories in these provinces in 1883-84, of which three were of the second class, *viz.*:—

Second Class.

Vizagapatam.	Bellary.	Trichinopoly.

Third Class.

Gopalpore.	Madras.	Madura.
Masulipatam.	Bangalore.	Cochin.
Secunderabad.	Negapatam.	Wellington.
Kurnool.	Salem.	Mercara.
Cuddapah.	Coimbatore.	Mangalore.

With the exception of Vizagapatam, which is the private observatory of Mr. A. V. Nursingrow, and Gopalpore, which was established for the purposes of the Bengal system of storm-warnings, all the above are under the administration of the Meteorological Reporter to the Government of Madras, extracts from whose report are given in Appendix G. A nominal list of the superintendents and observers is also appended (G II).

Miss Pogson reports that three of the observatories, *viz.*, Bellary, Cuddapah, and Secunderabad, were inspected by her during the past year. The Bellary observatory was found to be in fair condition, although susceptible of improvement in many points of detail, and complaint is made of great delay in the transmission of the registers to the Madras Office. Cuddapah being a newly established observatory, nothing can be said as to the work of the observer. The position is reported to be good, and the general arrangements satisfactory. The general condition of the Secunderabad observatory was found to be very satisfactory and highly creditable both to the superintendent and the observer, and it is remarked that this observatory, formerly the worst, now ranks as one of the best in the Presidency.

Of the second class observatory at Trichinopoly, complaint is made of "the obstinacy of the assistants" in not forwarding their reduced registers till many months after they are due. It does not appear, however, that recourse has been had to any other means of enforcing obedience than simple remonstrance, which could be ignored with impunity. The only other observatory at which the observer has given serious cause for complaint is Masulipatam. Under the direction of this office, this man was reduced to half pay in March last, but even this measure has failed to bring about any improvement, and his further services will be dispensed with shortly. The barometric returns of this station have long been untrustworthy, but it is uncertain whether this is not due to some accidental injury suffered by the instrument in transport. At Cochin the anemometric registers are quite valueless, which appears to be due, partly at least, to the faulty position of the anemometer.

At the remaining observatories there has been nothing calling for remark. Miss Pogson reports that their general work has been satisfactory during the year, and that there has been much improvement in the work of reducing the observations, which is required of all observers who draw the high rate of salary sanctioned for the old observatories in Madras, but in no other part of India.

OBSERVATORIES IN BRITISH BURMA.—The observatories in British Burma are eight in number, as in previous years, *viz.*, Akyab under the general direction of the Bengal Reporter, and noticed in his report; Diamond Island under the Central Office, and the remaining six enumerated in the following list under the immediate direction of the Sanitary Commissioner of British Burma.

Second Class.
Rangoon.

Third Class.

Bassein.
Diamond Island.
Akyab.
Thyetmio.
Mergui.
Tounghoo.
Moulmein.

Lists of the superintendents and observers during the past year are given in Appendices A, E, and H I.

The report of the Sanitary Commissioner on the condition of his observatories is given in Appendix H. He has inspected all of the six observatories under his local administration, and found them to be generally in satisfactory condition. Rangoon during the greater part of the year sent up registers as full of errors as in the previous year. The errors were, however, chiefly in the computation of the results. The observational work, if not quite satisfactory, appears from such tests as can be applied, less open to condemnation.

No special reference is made to the work of the Akyab observatory in Mr. Eliot's report, and it may therefore be inferred that he has no reason to repeat the unfavourable remarks made in his report of the previous year. The observatory of Diamond Island, which like that of Akyab is attached to the Electric Telegraph Office, has worked satisfactorily as far as can be judged from the registers.

The observatories of Bassein, Thyetmio, and Tounghoo have been better during the past year, but the barometric observations of the last two have been frequently of doubtful validity and do not appear to accord with those of other observatories. The site of the Tounghoo observatory has been changed during the year. The barometer at Moulmein appears in some months to be unduly low.

The majority of the Burmese observatories have generally ranked below those of other Provinces. Whether this be due to the fact of an inferior class of men being appointed as observers in Burma, or to other causes, it is difficult to say. But the fact is unquestionable.

A special allowance has been continued to the only observer in the Province who has been found deserving of it, *viz.*:—

Name.	Station.	Amount. Rs.
P. H. Hilbert	Moulmein	5

OBSERVATORIES AT THE BAY ISLANDS.—These, as in former years, are two, *viz.*:—

Third Class.

Port Blair (Andamans).	Nancowry (Nicobars).

The names of superintendents and observers are given in Appendix E.

Port Blair has worked satisfactorily during the past year. It is extremely important, owing to its proximity to the cyclone cradle, and, as was shown on a recent occasion, might be of much greater utility were it in telegraphic connection with the Indian mainland, as information could then be obtained of the formation of cyclones one or two days, and in some cases probably three or four days, earlier than at present. Nancowry furnished unsatisfactory registers during the first half of the year under report, and it became necessary to withhold a portion of the allowance, but since September the work has been satisfactory.

The special allowance awarded during the last two years has been continued to—

Name.	Station.	Amount. Rs.
J. F. Peters.	Port Blair.	5

EXTRA INDIAN OBSERVATORIES.—An addition has been made to the working extra Indian observatories during the past year, in that established at Victoria in the Island Mahé of the Seychelles. They are now eight in number, *viz.*:

Second Class.

Leh.	Aden.	Zanzibar.

Third Class.

Bushire.	Amini Divi (Lakhadives).
Quetta.	Mahé (Seychelles).
Katmandu.	

The names of the superintendents and observers are given in Appendix E, with the exception of those of Leh, which should be included in the list of the Punjab stations, and those of Zanzibar, which appear in the list accompanying the report of the Reporter for Western India.

The work of the observatories of Zanzibar and the Seychelles has already been noticed in the first part of this report, also the unsatisfactory results of the Amini Divi observatory, which is controlled by the Meteorological Reporter to the Madras Government.

The Leh observatory is not particularly mentioned in the Punjab report (Appendix C), but I have reason to believe that it has continued to work as satisfactorily as in previous years. I regret to learn that the Assistant Observer Bhola, whose excellent work under Dr. Scully in Yarkand has been prominently noticed in the publications of the Meteorological Office, has lost his appointment at the Leh observatory owing to his prolonged absence without leave. The meteorological observatory at this station remains independent of the actinometric observatory, which commenced work in November 1883, but it was left under the general superintendence of the Actinometric Observer, Sergeant Rowland, throughout the past winter, during the absence of the British Joint Commissioner.

The work of the Katmandu observatory has not been satisfactory. For several months in succession the registers had to be returned for correction, and owing to the observer's neglect of official instructions, some portions have had to be rejected as valueless.

The Aden observatory has hardly been so good as in previous years. The superintendent has found it difficult, if not impracticable, to obtain a competent observer at the rate of pay which is found sufficient in India, and it is now proposed to reduce Aden to a third class observatory, in which case the observations can be taken by the head clerk of the superintendent's office.

The Quetta registers have been satisfactory, as far as can be judged from internal evidence.

INSTRUMENTS.

In Appendix I, is given a return of the instruments in store at the beginning of the year, and of those received and issued by the Calcutta Meteorological Office, and includes the stock, receipts and issues of the Alipore observatory; and in Appendix K is a return of the instruments issued to each observatory. In this are incorporated the returns furnished by the local Reporters.

METEOROLOGICAL OFFICES AND OFFICE WORK.

The general control of the meteorological observatories and offices in the different provinces, with the local exceptions noticed in the foregoing sections, has been in the hands of the following officers during the year.

Name.	Office.	Provinces.
John Eliot, M.A. A. Pedler, Esq. (Offg.)	Meteorological Reporter to the Government of Bengal	Bengal and Assam.
S. A. Hill, B.Sc. Dr. Murray Thomson (Offg.)	Meteorological Reporter, North-Western Provinces and Oudh	North-Western Provinces, Oudh, Rajputana, and Central India (part).
Dr. E. Lawrie	Meteorological Reporter, Government of Punjab	Punjab and Kashmir.
A. N. Pearson, Esq. (Offg.)	Meteorological Reporter for Western India	Bombay, Berar, Rajputana, and Central India (part).
Miss Isis Pogson	Meteorological Reporter to Government of Madras	Madras, Mysore, and Hyderabad.
Dr. W. Watson Dr. J. H. Loch	Sanitary Commissioner, Central Provinces	Central Provinces.
Dr. Little	Sanitary Commissioner, Berar	Berar.
Dr. D. Sinclair	Sanitary Commissioner, British Burma	Burma.
Surgeon J. Reid	Senior Medical Officer, Bay Settlements	Andamans and Nicobars.

Mr. Eliot was absent on privilege leave during the months of August, September, and October, during which Mr. Pedler officiated as Meteorological Reporter to the Government of Bengal.

Mr. S. A. Hill left on furlough on the 20th May 1883, making over the charge of his office to Dr. Murray Thomson, who officiated up to the end of the year.

Mr. F. Chambers returned from leave on the 6th June, and took over charge of his appointment from Mr. Pearson; but on the 18th idem, having been appointed to officiate as Superintendent of the Colaba observatory, Mr. Pearson resumed the Reportership for Western India, and continued in that charge till the close of the year under report.

In the Punjab and Madras the permanent incumbents remained in charge of their respective offices.

The following table shows the number of stations, the registers of which were sent to each of the reporters respectively for reduction and verification during the year under report:—

PROVINCES.	METEOROLOGICAL REPORTERS.						TOTAL.
	India.	Bengal.	North-Western Provinces and Oudh.	Punjab.	Western India.	Madras.	
Bengal and Assam	3	19	...	...	...	...	22
North-Western Provinces and Oudh	1	15	...	...	...	...	16
Punjab	1	...	...	11	...	...	12
Rajputana and Central India	1	...	4	...	4	...	9
Central Provinces	11	...	...	...	...	...	11
Berar	1	...	...	...	4	...	5
Bombay	...	...	...	...	13	...	13
Madras, Mysore, and Coorg	1	1	...	...	...	15	17
Burma	7	1	...	...	...	...	8
Bay Islands	2	...	...	...	...	...	2
Extra Indian	6	...	...	...	1	1	8
TOTAL	34	21	19	11	22	16	123

This list does not include the registers of the Colaba observatory and of Jeypore, which are furnished to the Meteorological Office with all the necessary reductions with a partial exception in the case of Colaba. The observatory at Goa only sends telegraphic reports.

In Bengal, the North-Western Provinces, and in Bombay (partly) the Reporters superintend the rainfall registers of the district and subdivisional stations of their respective provinces, and prepare weekly and monthly returns of the rainfall, *viz.*:—

	Stations.
Bengal	167
North-Western Provinces and Oudh	253
Bombay (partially) over	400

The Bengal and Bombay Reporters also administer a system of storm warnings for the protection of the local ports; and the Bengal Reporter has had during the last year, in addition to the above, the working of the system of daily telegraphic weather reports (from the 15th May to the 15th November), which has already been noticed in the first part of this report. He also administers that department of the Central Office which deals with the current meteorology of the Bay of Bengal, and collects the meteorological observations from the log-books of ships entering the Port of Calcutta.

Mr. Dallas, Assistant Meteorological Reporter to the Government of India, has continued in charge of the Imperial system of daily weather reports, which, during the last year, were issued at Simla from the 16th May to the 15th November, and at Calcutta up to 15th May and from the 16th November to the 31st March. He also prepared monthly and semi-annual summaries of the weather reports, and is engaged in the reduction of the marine observations received from the London Meteorological Office, and in the preparation of weather charts of the Bay of Bengal, and the sea southward as far as the equator. The charts showing the barometric pressure and the wind directions for the first eight months of the year are now complete.

OFFICE ESTABLISHMENT.—The following is a return of the number of permanent employés in the offices of the several Meteorological Reporters:—

	India.	Bengal.	North-Western Provinces.	Punjab.	Western India.	Madras.	TOTAL.
Head Clerks	1	1	1	1	1	1	6
Computers	3	...	...	...	1	...	4
Clerks and Copyists . . .	3	2	1	2	...	3	11
Tabulators	18*	7	4	...	5	...	34
Draughtsmen	3	1	...	...	...	...	4
Artisans	...	3	...	...	...	...	3
Peons and Menials	10	4	2	1	2	1	20

The Central Office has remained under the charge of the Head Clerk, Babu Fanindra Mohun Basu, during the past year, and, I am glad to report, with the same satisfactory results as in previous years. The head clerk of the Bengal Meteorological Office, Babu Chandi Churn Chatterji, is reported by Mr. Eliot to be a most efficient head clerk. The Meteorological Reporter for the Punjab also speaks well of the services of the chief observer and head clerk of his office, Jasput Rai.

Four tabulators and a draughtsman were added to the Bengal Office at the beginning of the year under report, for the purposes of the provincial system of daily weather report; and three or four clerks had to be entertained temporarily, in addition to the above, from the 15th May to the 15th November. One man has been added to each of the offices of the Reporters to the Governments of the North-Western Provinces, the Punjab, and Madras.

---

* Besides these, there are four temporary clerks for reducing the London Meteorological Office marine logs.

WEATHER BULLETINS AND STORM SIGNAL SERVICE.—The daily weather reports of the Imperial office were issued at Simla from the 16th May to the 15th November, and at Calcutta during the remainder of the year. They now give the 10 A.M. observations of the principal meteorological elements of 96 stations, together with the maximum and minimum temperatures, the average wind movement, the rainfall and the general weather of the preceding 24 hours; and, in the rainy season, the rainfall of 28 additional stations. The tabulated observations, with general remarks on the weather of the day, are sent to press at 5 P.M. daily, and the printed sheets are distributed on the following morning. The verbal summary is telegraphed at 5 P.M. daily to the seats of the Provincial Governments, and copies are sent to the Allahabad and Calcutta newspapers.

An independent provincial system of daily weather reports, giving the observations at 10 A.M. of 31 stations, was organised at the beginning of the past year by the Meteorological Reporter to the Government of Bengal, at the cost of the Local Government. It is in operation from the 15th May to the 15th November. The telegrams are received as urgent, and the daily report, including a verbal description of the weather, is sent to the Bengal Secretariat Press at 4 P.M. daily, and printed and distributed from the press in time for the evening mails. A full description of the working of this system is given in Mr. Eliot's report (Appendix A).

The Bengal system of daily weather reports, based on telegrams received as "urgent" from 17 stations around the coasts of Bay of the Bengal, which forms part of the storm warning service, is independent of the above. This is carried on throughout the year, the daily bulletin, illustrated by a chart of the Bay, being lithographed in the office and distributed by peons or through the afternoon post.

The past year was a stormy year at the head of the Bay of Bengal, not less than ten storms being recorded in Mr Eliot's report. They were all small storms, and with the exception of the second on the list, *viz.*, that of June 26th to July 4th, did not appear to warrant the hoisting of the storm signals.

The working of the storm signal servce of the Bombay coasts is noticed in Mr. Pearson's report (Appendix F). The daily reports of the ten stations which transmit telegrams are not printed for the Bombay Meteorological Office, but a manuscript copy is posted at the office and another sent to the *Times of India*, and an abstract to the Bombay Gazette. Only one storm occurred during the year, of sufficient importance to justify the hoisting of the storm signals, *viz.*, the same storm for which the signals were hoisted in Bengal. This storm crossed the peninsula, its daily progress being reported in the Simla weather reports, and also telegraphed from Simla to Bombay. The working of the Bombay system has been expedited by connecting the Meteorological Office with the Telegraph Office by telephone.

WEEKLY, MONTHLY, AND SEMI-ANNUAL REPORTS.—From May to October, both inclusive, a monthly descriptive summary of the chief weather characteristics of the month, based on the telegraphic reports, was prepared in the Simla Office, and published in the Gazette; and in May and November, a general summary of the Indian meteorology of the preceding six months was drawn up and published in like manner. Appended to the summary of the six months November 1882 to April 1883, published in the *Gazette of India* on the 2nd June, was a note in which, after adverting to the distribution and amount of the Himalayan snows in the preceding winter and spring, the conclusion was announced that if the views "that an unusual extent and thickness of snow on the Himalaya is productive of dry north-west and west winds in India are valid, we must be prepared for a long spell of dry weather and a retarded rainfall in the Upper Provinces." This is the first time that the office has ventured to base a prediction on the facts of the snowfall, or indeed on any other foundation than a general resemblance of the weather of the earlier months of the year to that of the corresponding season of some previous year. The result was therefore awaited with much interest. This result was given in a note appended to the next semi-annual weather report, published in November. It was not in exact accordance with the terms of the above forecast, inasmuch as the setting in of the rains in the Upper Provinces took place only a few days later than on the average, and rather more than a fortnight of rainy weather preceded the period of drought, which had been foreseen, and which set in on the 19th July. After this date, the north-west current, which had existed throughout at no great height above the hills of the outer Himalaya, "descended and replaced the monsoon, prevailing over the whole of North-Western India and Rajputana, and influencing the winds, even down to the Deccan on the south and to Behar on the east." The final conclusion was drawn that "the experience of the present season has given strong confirmation of the validity of the view on which the forecast was based." Some further notice of this subject has already been given in Part I of this report.

In Bengal, a weekly meteorological and rainfall statement has been published by the Reporter, and also a monthly meteorological and rainfall statement, giving the averages of 44 observatories, and a complete statement of the daily rainfall during the month, at 166 raingauge stations. Both these periodical issues are accompanied by a full verbal description of the general results.

No mention is made in Dr. Murray Thomson's report of the periodical publications of the North-Western Provinces Office, probably because they were of the same character as in preceding years.

In Bombay, monthly abstracts of the results of the observatories have been published in the Government Gazette as in previous years.

ANNUAL REPORTS.—The report on the meteorology of the year 1882 was complete, and in the printer's hands before the end of December 1883, and it was submitted to Government in its complete form on the 14th July 1884. The printing of the text was completed in April, but the issue was again delayed by the preparation of the plates, a delay which was extended by the loss of the set first prepared by the draughtsman, and the consequent necessity of reproducing them.

The report gives tables of temperature for 130 stations, and rainfall returns of 457 stations, being a decrease of one of the former, and an increase of 40 of the latter, on the numbers respectively given in the report of the previous year, in the corresponding tables. The returns of pressure, wind direction and other meteorological elements are nearly as numerous as those of temperature. The elements tabulated in the Appendices are as follow. I give for comparison the number of registers summarised in the corresponding tables of the reports of the four previous years :—

	NUMBER OF STATIONS.				
	1878.	1879.	1880.	1881.	1882.
Equilibrium temperatures of solar radiation	99	106	109	106	112
Temperature of nocturnal radiation	97	100	108	106	104
Temperature of the ground	...	...	2	4	4
Mean and extreme air temperatures	116	123	126	131	130
Sea-level equivalents of mean temperature	100	101	105	108	108
Means and extremes of atmospheric pressure	113	119	122	125	124
Sea-level equivalents of mean atmospheric pressure	96	98	105	107	108
Direction and movement of winds	113	118	124	127	125
Temperature of evaporation	106	111	115	121	120
Tension of atmospheric vapour	113	120	123	128	127
Mean relative humidity	114	120	123	128	127
Mean proportion of clouded sky	110	118	122	125	124
Inches of rainfall in each month	253	365	399	417	457
Number of days on which rainfall was measured	276	365	379	403	457

The descriptive letter press discusses the chief characteristics of the meteorology of the year. It includes 27 numbered tables, giving the average values of all the more important elements, for all stations that have furnished returns for three years and upwards; and the report is illustrated with 8 plates, of which one is a chart showing the position of all Indian observatories and raingauge stations; three, in coloured lithography, represent the average distribution of temperature, pressure and winds in each month of the year; and the remainder illustrate particular phases of weather, *viz.*, certain instances of rainfall in the cold weather; the progress of a monsoon storm across Bengal; the conditions accompanying a break in the rains in August; and the progress of a cyclone in October. This last has been made the subject of a detailed investigation, the results of which have been embodied in a memoir by Mr. Eliot which is now in the press.

The original observations of six observatories, *viz.*, Calcutta, Lucknow, Lahore, Nagpur, Bombay, and Madras, were issued as a distinct publication in monthly parts, and form a small quarto volume, the fourth of the series, which was issued in a complete form in October 1883. Those for 1883, the fifth volume of the series, was issued in May 1884.

A report on the rainfall of the North-Western Provinces in 1883, was compiled in the Office of the Meteorological Reporter for the North-Western Provinces, and published in the Government Gazette of the 29th March last; and one on the meteorology of the North-Western Provinces in 1882-83 was prepared by Mr. S. A. Hill and printed and distributed before his departure on leave.

Mr. Pearson also prepared a brief sketch of the meteorology of the Bombay Presidency in 1882-83.

MISCELLANEOUS PUBLICATIONS.—Part II of the second volume of the Indian Meteorological Memoirs was issued in November 1883. It contains a memoir by myself on the storms of the west coast and on the land formed cyclone of Gujarat of July 1881, and a very important paper by Mr. Hill on the normal temperature of Northern India, illustrated by a series of isothermal charts for the year and for each month.

Another publication of the office is the chart of the average rainfall of India, which has been already noticed in the Administration Report for last year, and briefly in Part I of the present report.

A paper was communicated to the March meeting of the Asiatic Society of Bengal on the "Theory of the cold weather rains of Northern India," and will shortly be published in the Society's Journal; and another paper "On the connection of the Himalayan snowfall with dry winds and seasons of drought in India" was read before the meeting of the Royal Society on the 1st May 1884.

Dr. Murray Thomson mentions the preparation of a new edition of Mr. Hill's paper (published in 1879). "On the rainfall of the North-Western Provinces and Oudh," and Mr. Pearson that of a paper communicated to the Royal Meteorological Society of London on "Some results of an examination of the barometric variation in Western India."

Appendix L gives a list of the Government officials, libraries, observatories, societies, &c., to which the publications of this office are presented, including those which send their own publications in exchange.

LIBRARY.

The library is contained in six large double book-cases, and is in excellent condition; but owing to the want of space in the office, the book-cases are sufficient only for the preservation of the books. Any systematic arrangement, according to subject-matter, is impossible; and the book-cases are distributed in different parts of the office building. It will be impossible to effect a proper re-arrangement, and to render the library useful for general reference, until the office is removed to a much larger building.

A list of the additions to the library is given in Appendix M.

HENRY F. BLANFORD,

Meteorological Reporter to the Government of India.

SIMLA:

The 22nd July 1884.

APPENDIX A.

Extracts from the Administration Report of the Meteorological Reporter to the Government of Bengal for the year 1883-84.

THE Bengal Meteorological Department was under my control during the whole of the past official year, except the months of August, September, and October, when I was absent on privilege leave. Mr. Alexander Pedler, who had acted previously for me on four occasions, was again appointed to officiate as Meteorological Reporter during my absence.

During the past year, the extensions of the Bengal Meteorological Department, which were proposed and sanctioned during the preceding year, and the character, extent, and scope of which were stated in my Administration Report for the year 1882-83, were completely and successfully effected. The past year has hence been one of considerable importance in the working of this department, and it seems desirable to place on record a statement of the manner in which the proposed extensions were carried into effect during the year.

The proposals which were finally sanctioned in March 1883 by the Government of India, at the request of the Government of Bengal, authorised and provided for a number of changes, of which the following were the most important :—

1st.—The establishment of a large number of additional stations, recording observations at 10 A.M. only, to be distributed throughout the province in such a way as to give a fairly complete view of all the more important meteorological changes in the province.

2nd.—Provision for additional inspection of the observatories at all seasons of the year, so that the source of any error in the observations detected by the examination of the returns sent to the office might be immediately traced, if necessary, by a visit of an inspecting officer to the observatory. By this means errors, whether due to instrumental changes, or to carelessness, or ignorance, or other defects on the part of the observer, might be speedily rectified, and the accumulation of inaccurate observations prevented.

3rd.—Special arrangements for the speedy and continuous transmission of the meteorological and rainfall observations taken throughout the province, day by day, to the Bengal Meteorological Office, where they may be at once reduced and tabulated, and the various meteorological returns be prepared for publication without any unnecessary delay.

4th.—The publication of daily weather reports for the province of Bengal during the south-west monsoon, or from May 15th to November 15th, and of weekly and monthly meteorological and rainfall returns in the *Calcutta Gazette*, with short summaries giving the more important features of the weather and rainfall for the period in question, and their distribution to district officers and certain officers in the Irrigation, Public Works, and other departments.

5th.—An increase in the number of clerks in the Bengal Meteorological Office in order to enable the additional work to be performed fully, accurately, and rapidly. A considerable increase was necessary, in order not merely to deal with the larger number of observations transmitted to this office, in consequence of the increased number of observatories, but also to bring up and to maintain the whole of the office work up to date, and to go through the whole of the observations taken at the older established stations, and obtain daily and weekly means of the elements of meteorological observation, in order to enable the peculiarities of the weather for any period in discussion to be stated quantitatively as deviations from the normal or average conditions for that period.

The scheme in its final and complete form was submitted by the Government of Bengal to the Government of India on the 29th January, 1883, and sanction was granted by the Government of

India on terms which were accepted by the Government of Bengal. These terms were in effect that the Bengal Government should contribute a sum from its provincial funds equal to the estimated cost of the extensions to the Imperial Meteorological grant, and that the money should be expended in carrying out the proposals of the Government of Bengal, but that the control and supervision of the additional observatories should be exercised by the Meteorological Reporter to the Government of India. The effect of this is that the whole of the observatories now established in Bengal are, as before, subject to the control and orders of the Imperial Reporter, and the working of every part of the system is under his supervision. This arrangement has been perfectly satisfactory during the past year. It has secured on the one hand the extension of the department, which was considered essential by the Government of Bengal, whilst it has maintained uniformity of system and control by a single head—most important features in a scientific department, such as a Meteorological Department is or ought to be.

Establishment of additional observatories.—The stations at which it was finally decided to establish observatories were as follows :—

Orissa	Balasore.
South-West Bengal	Midnapore. Ranigunge.
East Bengal	Noakholly. Burrisaul. Serajgunge. Commillah. Furreedpore. Mymensigh.
North Bengal	Rampore Beauleah. Dinagepore. Rungpore. Julpigoree.
Behar	Bhagulpore. Chupra. Motihari. Buxar. Arrah. Dehree.
Sonthal Pergunnahs and Chutia Nagpur	Nya Doomka. Ranchi Chyebassa.

It was originally intended to establish and work these observatories entirely through the agency of the Public Works Department, but this was found to be in a few cases (*viz.*, Serajgunge, Chyebassa, Ranigunge, and Nya Doomka) impracticable.

As soon as the letter of the Government of India sanctioning the proposals was received (March 15th, 1883), instructions were issued by the Secretary to the Government of Bengal, Public Works Department, to the Executive Engineers in whose divisions the stations selected for observatories were situated, requesting them to choose sites and arrange for the early construction of sheds and the selection of suitable officers in the establishment of the Public Works to take the observations. Copies of plans of the pattern thermometer shed approved and adopted by the Meteorological Reporter to the Government of India were sent, and a few rules for guidance in the selection of a suitable site. It was originally intended to commence the work of observation under the new system from the 1st of April, but this was, of course, not possible, in consequence of the sanction of the scheme by the Government of India not being received until nearly the end of March. As early erection of the sheds and the establishment of the observatories was an imperative necessity, in order to commence the publication of the Bengal Daily Weather Reports on the 15th May, it was necessary to leave the selection of sites entirely to the judgment of the Executive Engineers or their subordinates. In the great majority of cases very suitable sites were chosen, and the sheds erected as rapidly as could be expected under the circumstances. In one or two cases unexpected difficulties arose in obtaining well exposed sites, the local authorities opposing the erection of the shed. In one case, the Executive Engineer, after the shed had been built on a suitable site, was ordered by the Commissioner of the Division to take it down and re-erect it on a distant and much more objectionable site.

The following table gives the dates on which observations were first taken and transmitted to the Bengal Meteorological Office at the newly established observatories :—

Meteorological Division.	Station.	Date of commencement.
Orissa	Balasore	22nd May 1883.
South-West Bengal	Midnapore	1st June "
	Ranigunge	10th June "
East Bengal	Noakholly	3rd August "
	Burrisaul	2nd July "
	Serajgunge	4th August "
	Commillah	1st June "
	Furreedpore	5th July "
	Mymensingh	18th June "
North Bengal	Rampore Beauleah	27th August "
	Dinagepore	20th May "
	Rungpore	22nd May "
	Julpigoree	15th May "
Behar	Bhagulpore	4th June "
	Chupra	8th June "
	Motihari	30th May "
	Buxar	3rd June "
	Arrah	21st July "
	Dehree	4th June "
Sonthal Pergunnahs and Chutia Nagpur.	Nya Doomka	5th July "
	Ranchi	11th July "
	Chyebassa	21st August "

Inspection of observatories.—This is, as I have frequently pointed out, of the utmost importance, in order to secure continuous accuracy of observation. It is the one part of my duties as Provincial Reporter which I can only perform during the cold weather vacation. In consequence of the changes in the college vacations recently introduced, I shall have less opportunity than previously of inspecting observatories. I proposed last year that an inspecting officer should be sanctioned, who should perform the combined duties of draughtsman and inspecting officer. A passed student was obtained from the Thomason Engineering College, Roorkee. It was, however, found that his time was so fully occupied with the preparation of the ordinary and the additional rainfall charts (which I submitted to the Government during the course of the south-west monsoon), that it became necessary to propose another arrangement. Advantage was taken of his transfer to the Office of the Executive Engineer, Cawnpore, to appoint a draughtsman on a slightly lower salary, and I applied to Government to sanction the transferrence of the amount saved to increase the pay of the head clerk, on condition that he assisted me in the work of inspection. This arrangement was approved by Government. As it is inconvenient for both the head clerk and myself to be absent at the same time, I was only able to take him with me on inspection to a single observatory. After the termination of my cold weather vacation, I sent him to inspect the observatories in Eastern Bengal. He did this in so efficient a manner, as to fully satisfy me of his ability and capacity to perform the duties of inspecting officer. He will thus in future be of valuable assistance, and enable me to secure the inspection of any observatory at any time that it may seem necessary or desirable.

The work of inspection during the past year was almost entirely confined to the cold weather period—November to March. The amount of inspection done will show the value of this new arrangement. The following stations were inspected by myself:—

Station.	Dates.	Station.	Dates.
Dhubri	December, 14th and 15th.	Bhagulpore	November, 17th and 18th.
Gauhati	ditto, 27th and 28th.	Chupra	December, 5th and 6th.
Tezpur	ditto, 24th.	Durbhunga	November, 20th.
Sibsagar	ditto, 20th to 22nd.	Nya Doomka	ditto, 26th.
Rungpore	January, 2nd, 1884.	Buxar	December, 7th.
Darjeeling	ditto, 4th.	Arrah	ditto, 4th and 5th.
Julpigoree	ditto, 6th.	Ranigunge	ditto, 2nd and 3rd, and June, 23rd and 24th.
Patna	November, 23rd.		
Motihari	ditto, 21st and 22nd.		

and the following by my head clerk:—

Station.	Dates.	Station.	Dates.
Julpigoree	January, 6th.	Furreedpore	February, 16th.
Dinagepore	ditto, 8th.	Burrisaul	January, 31st, and February, 1st.
Rampore Beauleah	ditto, 10th and 11th.	Commillah	February, 9th.
Serajgunge	February, 20th, 21st, and 22nd.	Noakholly	ditto, 6th.
Mymensingh	ditto, 25th, 26th, and 27th.	Gya	March, 25th and 26th.
Dacca	ditto, 13th.	Dehree	ditto, 22nd.

Arrangements for transmission of the observations to the Central Office.—The methods I proposed to employ for the regular transmission of the meteorological and rainfall observations were given in the last Administration Report.

The 10 A.M. observations, taken at the various meteorological stations, are forwarded daily to the office in various ways, according to the position of the observatory with respect to telegraphic and postal communication and the purposes for which the observations are utilized.

Urgent telegrams are sent daily throughout the whole year by the following stations. These are required for the Bay of Bengal Weather Report:—

Saugor Island.
Balasore.
Dacca.
Chittagong.
Cuttack.
False Point.

Similar telegrams are also sent by the following stations which are not in Bengal:—

Diamond Island.
Akyab.
Gopalpore.
Vizagapatam.
Coconada.
Masulipatam.
Galle.
Madras.
Nagapatam.
Trincomalee.

The following stations send urgent or ordinary telegrams during the period, 15th May to 15th November, when the 10 A.M. observations are required for the compilation of the Bengal Weather Report:—

Mymensingh.
Commillah.
Serajgunge.
Rungpore.
Dinagepore.
Julpigoree.
Darjeeling.
Purneah.
Durbhunga.
Motihari.
Chuprah.
Midnapur.
Burdwan.
Ranigunge.
Jessore.
Rampur Beauleah.
Bhagulpore.
Patna.
Arrah.
Buxar.
Dehree.
Gya.
Hazaribagh.

The remaining observatories are at stations to which telegraphic communication has not yet been extended; hence they can only transmit their observations by post. These are—

Ranchi.
Chyebassa.
Burrisaul.
Noakholly.
Nya Doomka.
Furreedpore.
Berhampore.

Those stations, which forward weather telegrams, also transmit by post copies of the observations sent by telegraph, so that errors, due to transmission, are eliminated before the determination of the weekly and monthly averages for publication in the Gazette, and the entry of the reduced observations in the volumes of records in which they are filed. In the case of the Imperial observatories this is done by means of Form B, supplied by the India Meteorological Office, and at the provincial or newly established observatories by means of postal cards. These are despatched daily by the first post after the time of observation.

The non-telegraphing provincial third class observatories forward their observations daily by means of post-cards. During the past year, they have, almost without exception, transmitted the observations regularly, and have thus enabled me to publish the weekly meteorological returns in a complete form.

The only station, the name of which appears in the weekly meteorological forms, but which fails to send in its observations in time, is Demagiri. This, however, is not an observatory maintained by Government, but a voluntary observatory, started in 1881 by the medical officer.

The rainfall observations at the 166 rainfall-recording stations are forwarded mainly by postal cards daily or weekly.

If rain falls during any day, the amount is entered in a postal card, Form C, and sent off by the first dâk leaving the station after the hour of observation (6 P.M.) for Calcutta. The returns of actual rainfall are, by this means, forwarded immediately after occurrence. As returns are occasionally lost, all stations are also required to send a weekly return on a postal card giving the amounts (nil or otherwise) of the rain on each day of the preceding week. This is useful as a check on the daily returns as received, and also as confirming the non-occurrence of rainfall during any week, which otherwise would be indicated only by the non-arrival of daily post-cards.

The number of postal card forms supplied to the observatories during the year was—

	Number.
Form G for meteorological observations	9,450
„ C for daily rainfall	50,662
„ D for weekly rainfall	12,994

A few stations are so situated that postal communication is very slow, and the returns for the last day of the week and the weekly return itself would invariably be received too late for inclusion in the weekly rainfall report. In these cases, special arrangements were made for the transmission of the weekly returns by dâk to the nearest telegraphic offices, from which they are telegraphed to Calcutta.

The rainfall stations which report weekly in this manner are—

Jamalpore.
False Point.
Saugor Island.
Rangamati.
Ruma.
Sorah.
Jellasore.
Jagatsingpore.
Barripada.
Pooree.
Cox's Bazar.
Bhola.
Palamow.

The arrangements are thus somewhat complex and required some time to effect. However, the great majority of the officers co-operated most heartily, and the changes were made on the whole with less trouble and much greater readiness than I expected.

Publication of Returns.—The frequent publication of meteorological statements giving the latest possible information was one of the most important features of the sanctioned extensions. This was carried out during the past year by the publication of—

1st.—The Bengal Weather Report from the 15th of May until the 6th November. When the extended system was fully established, telegrams giving the 10 A.M. observations were received daily from 31 stations in the province. These were reduced and tabulated as they arrived. The whole of each day's telegrams were received and the observations tabulated ready for the press by 3-30 P.M. daily. A brief summary was then written, describing in words the salient features and peculiarities of the weather of the previous 24 hours, and the whole sent off at 4 P.M. to the Bengal Secretariat Press, where it was printed in time for distribution to district officers by the mail of that evening. The work of distributing the report was done entirely by the Bengal Secretariat Press.

2nd.—A weekly meteorological and rainfall statement. The first part of this gives the average and extreme values of the elements of meteorological observations at all the observatories of the province for the week, and of the average district rainfall for the week, and its variation from the normal rainfall for the week. The second part gives the amount of the rainfall, day by day, for the preceding week, at each of the 166 sub-divisional and rainfall-recording stations, the total rainfall of the week, of the month up to date, and of the total rainfall from 15th May up to date, with corresponding normal or average amounts for comparison. A summary is added directing attention to the more important features of the meteorology for the week, more especially the distribution of rainfall. This return is published in the *Calcutta Gazette* every Wednesday morning, and gives the meteorological and rainfall observations for the week preceding the previous Friday evening.

3rd.—A monthly meteorological and rainfall statement, published usually during the second week of each month, and giving averages of the observations taken at the 44 observatories during the preceding month, a complete statement of the daily rainfall during the month at the 166 rainfall-recording or sub-divisional stations, and a summary giving the characteristics of the meteorology of the province during the previous month, and its more important points of difference from the normal weather of the period, and a brief analysis of the distribution of rainfall over the province during the month.

Preparation of daily averages.—The only other point which it appears necessary to describe was the method adopted to obtain the daily and weekly averages of the barometric height, maximum and minimum temperature, and rainfall required for the comparative statements and columns in the daily and weekly weather reports. The only averages hitherto obtained and used in the office were monthly averages. The reduced observations were recorded on large forms, each form containing the observations at a single station for a month, and the averages of these observations. This was a sufficient and satisfactory mode of preserving the observations, so long as all that was required was the preparation of monthly averages for the India Meteorological Office and for publication in the *Calcutta Gazette.*

The record of the observations in monthly sheets was on the other hand extremely inconvenient for the calculation of daily and weekly averages. It was hence found necessary to copy them into books specially prepared, so that the observations for the same day of the year might be found in the same column. These books thus contain a systematic record of the elements of observation to which they refer, and enable the average values of those elements of observation at any of the meteorological stations to be immediately determined for a day, week, or any other short period. The tabulation of the results in this way has also the further advantage of enabling the highest and lowest values of the elements of observation at any meteorological station recorded since the establishment of the observatory at that station for any period of the year to be immediately ascertained.

Last year the 10 A.M. barometric readings, the maximum and minimum in shade temperatures, and the rainfall observations taken at the eighteen observatories that have been established for some years in the province, were copied from the monthly sheets into four large folio volumes, which will form the permanent record of these observations in future. If the strength of my office enable me to do it, I hope during the present year to have the humidity, cloud and wind amount tabulated in the same manner, when it will be possible to compare all the elements of observation (except wind direction) at 10 A.M. on any day of the year with the corresponding mean values for that day.

The rainfall observations at all the sub-divisional stations (160 in number) preserved in the office were also collected together and tabulated in the same manner, and the daily and weekly means obtained. These are the actual means and are employed for comparison in the weekly reports. The rainfall returns for each station will continue to be added, so that the twenty-four folio volumes which contain these observations will form the permanent record of the rainfall of the province.

Position of new observatories.—The following table giving the latitude, longitude, and elevation of the level of the mercury in the barometer cistern, so far as this has been ascertained at the additional observatories, is added :—

Latitudes, Longitudes, and Elevations of the Provincial Third Class Meteorological Observatories.

Meteorological Division.	Station.	Latitude.	Longitude.	Elevation in feet above mean sea level.	Level determined.	How determined.	Authority for elevation.
Orissa . .	Balasore . . .	21° 30′ 12″	86° 58′ 16″	56·15	Barometer cistern at observatory.	Levelled to G. T. S. B. M. at False Point.	Executive Engineer.
South-West Bengal.	Midnapore . . .	22° 15′ 33″	87° 21′ 45″	148·38	Barometer cistern at the Executive Engineer's Office.	Levelled to S. B. M. .	Ditto ditto.
	Ranigunge . . .	25° 51′ 40″	87° 57′ 55″	?			
East Bengal .	Noakholly . . .	22° 48′	91° 6′	38·59	Barometer cistern on the 1st floor of the circuit-house.	Levelled to B. M. Chittagong Railway Survey.	Ditto ditto.
	Burrisaul . . .	21° 41′ 40″	90° 24′ 30″	?			
	Serajgunge . . .	24° 26′ 58″	89° 47′	?			
	Commillah . . .	23° 28′	91° 14′	34·74	Ditto ditto .	Ditto ditto .	Ditto ditto.
	Furredpore . . .	23° 36′	89° 52′	?			
	Mymensingh . .	24° 45′ 13″	90° 27′ 21″	?			
North Bengal .	Rampore Beauleah .	24° 22′ 5″	88° 38′ 55″	71·97			
	Dinagepore . . .	25° 38′	88° 40′ 46″	117·92	Barometer cistern .	Levelled to G. T. S. B. M.	Assistant Engineer, Julpigoree Division.
	Rungpore . . .	25° 44′ 55″	89° 17′ 40″	123·00	Ditto ditto .	Ditto ditto .	Ditto ditto.
	Julpigoree . . .	26° 32′ 20″	88° 45′ 38″	283·70	Ditto ditto .	Ditto ditto .	Ditto ditto.
	Bhagulpore . . .	26° 10′	83° 52′	160·18	Ditto ditto .	Levelled to G. T. S. B. M. on Bhagulpore Church.	
Behar . .	Chupra . . .	25° 46′ 42″	84° 46′ 49″	?	?		
	Motihari . . .	26° 39′ 46″	84° 57′ 29″	223·6	Barometer cistern .	By spirit levelling from G. T. S. B. M.	Sub-Overseer, P. W. Dept.
	Buxar	25° 34′ 24″	84° 0′ 46″	239·22			
	Arrah	25° 33′ 46″	84° 42′ 22″	192·82	Barometer cistern, Superintending Engineer's room.	Levelled to G. T. S. B. M. at Railway Station.	P. W. Dept.
	Dehree . . .	24° 54′ 30″	84° 12′ 30″	351·14	Barometer cistern in dispensary.	Ditto ditto.	
Sonthal Pegnonahs and Chutia Nagpore.	Nya Doomka . .	24° 16′	87° 17′ 30″	?			
	Ranchi . . .	23° 22′ 37″	85° 22′ 6″	2,128·14	Barometer cistern .	Levelled to G. T. S. B. M. on the doorway of the Lutheran Church at Ranchi.	Overseer, P. W. Dept.
	Chyebassa . . .	22° 32′ 50″	85° 50′ 57″	?			

Second class observatories.—These are, as last year, seven in number, of which five are in Bengal and two in Assam. The following table gives the superintendents and observers at these observatories during the year:—

STATIONS.	Superintendents.	Superintendent's allowance.	Observers.	Observer's allowance.	Assistant Observers.	Assistant Observer's allowance.
		Rs.		Rs.		Rs.
Sibsagar	Dr. R. M. Meiklejohn[1] „ T. D. O'Partridge[2]	30	Baboo Dandadhor Dutt Barua.*	30	Baboo Ratneswar Gogoi.	10
Dhubri	Surgeon J. Mullane[3] Assistant Surgeon Atul Chandra Rai.[4] Surgeon Edwin Dobson[6]	30	Munshi Monirud-din Ahmed.†	30	Kadimuddin[6] Baboo Andia Prosad De.[7]	10
Hazaribagh	„ R. Cobb	30	Baboo Nathoo Lal	30	Dwarkanath	10
Bankipore	„ T. G. French	30	Munshi Mohubbut Lal.	30	Mudden Mahunlal	10
Saugor Island	*Nil*	...	Mr. A. J. Moth[8] „ C. Williams[9] „ S. Holge[10] „ J. A. Thomas[11] „ S. Holge[12] „ C. Williams[13] „ J. A. Thomas[14]	45	.... *Nil.*	
Cuttack	*Nil*	...	„ J. C. Smith[15]† „ H. W. Alley[17]	32	Mr. H. W. Alley*[16] Mr. B. Sebastian[18]	13
Chittagong	*Nil*	...	„ P. O. Pereira	30	„ J. Dias[19] „ F. X. Derajo[20]	15

[1] From 1st April to 6th September 1883.
[2] „ 7th September 1883 to 31st March 1884.
[3] „ 1st April to 18th August 1883.
[4] „ 19th August to 3rd November 1883.
[5] „ 4th November 1883 to 31st March 1884.
[6] „ 1st April to 6th October 1883.
[7] „ 7th October 1883 to 31st March 1884.
[8] „ 1st April to 1st June.
[9] „ 2nd June to 14th June 1883.
[10] „ 15th June to 14th August 1883.
[11] „ 15th August to 31st October 1883.
[12] „ 1st November to 24th November 1883.
[13] From 25th November to 30th November 1883.
[14] „ 1st December 1883 to 31st March 1884.
[15] „ 1st to 15th April and 20th July to 6th December 1883.
[16] „ 1st to 15th April and 20th July to 6th December 1883.
[17] „ 16th April to 19th July 1883 and 7th December 1883 to 31st March 1884.
[18] „ 16th April to 19th July 1883 and 7th December 1883 to 31st March 1884.
[19] „ 1st to 22nd April and 23rd July to 31st March (was on privilege leave).
[20] „ 23rd April to 22nd July 1883.

* Received special allowance of Rs. 5 per month for good services.

† Received special allowance of Rs. 10 per month for meritorious services.

Five of these observatories, *viz.*, Dhubri, Hazaribagh, Cuttack, Chittagong, and Saugor Island have self-registering anemographs. At the three first named stations the anemographs are of the Casella patern, which record the wind direction and amount at intervals of one hour. The remaining stations—Saugor Island and Chittagong—are provided with Beckley's anemographs, which register wind direction and amount continuously. There were several breaks exceeding 24 hours in the working of these instruments, the dates of which are given in the following table:—

STATIONS.	Dates of commencement of work.	Periods during which instrument was out of order during 1883-84.
Dhubri	18th March 1882	From October 26th 8 A.M. to 27th 5 P.M.
Hazaribagh	15th April 1880	Nil.
Cuttack	11th April 1879	September 18th to 19th and December 16th to 18th.
Chittagong	20th June 1879	May 21st to 23rd, June 9th to 10th, July 11th to 13th.
Saugor Island	9th February 1880 . . .	May 21st to 23rd, October 25th to 27th.

Three of these observatories were visited during the cold weather, *viz.*, Dhubri, Sibsagar, and Bankipore.

Dhubri Observatory—Was inspected on the 14th and 15th of December 1883. No change of importance has been made in the position of the shed or the arrangement of the instruments since my last inspection in March 1882. The anemograph tower was erected shortly after that visit, and is situated on a fairly open site near to the thermometer shed. The tower is well built and in good repair. The barometer is kept in the lower room. The recording part of the anemograph is placed on a table in the upper room of the floor, which is by no means so steady and rigid as it ought to be for such an instrument. The observer is, however, very careful in looking after it, and has made one or two slight additions which not only show his interest in it, but which improve, to some extent, the working of the instrument. The anemograph and barometer were both found to be in very good order. The barometer was also cleaned in order to free it from the large amount of oxidized mercury which had formed in the cistern.

The thermometer shed was in good order. The instruments were clean and in very satisfactory condition. The observatory continues to maintain its high character, and is thoroughly satisfactory in character and accurate and valuable in its observations.

Sibsagar Observatory—Was inspected on 20th to 22nd December 1883 for the first time since its establishment in 1874. The station is situated at a distance of about nine miles to the south of the Brahmaputra in a flat open district. Much of the country between the station and the river is covered with cane jungle. To the south of the station, at a distance of over 20 miles, the Naga Hills rise up to a height of 2,000 to 6,500 feet and form a very marked feature. The Himalayas, the nearest snow peaks of which are at a distance of 70 miles, are also very distinctly visible in clear weather. The station itself is built on the banks of a very large square tank, about two miles in perimeter, the level of the water of which is about 20 feet above that of the adjacent country. The banks, supporting and containing this water, are very wide and large. The observatory is situated on ground formerly occupied by the civil jail on the eastern bank of the tank. The shed is unfortunately placed on the edge of the bank where it begins to slope down to a large shallow excavation, from which the earth was removed to form part of the bank, and is now filled with water. It is also shut in between two buildings (detached portions of the old jail), one of which is used by the observer as his residence, and the other as an office. This second or northern building contains the barometer. This instrument was placed in good light and was in good order, except that the surface of the mercury was oxidized. This was removed. The thermometers were tested and were all in good order. The shed was in fair condition. It was surrounded by a bamboo fence. The observer was requested to cut down several shrubs and high grass which interfered to some slight extent with the free circulation of the air in the shed. The anemometer and wind-vane are placed on the roof of the building containing the barometer, to which access is given by a strong iron ladder. They were in good order. The only defect was that the anemometer was screwed to the top of a long iron rod fixed on the roof, and hence oscillated to some extent with the motion of the air. The observer was instructed to have a small brick pillar built and the anemometer fastened to a shorter rod, the lower end of which is to be buried in the brick pillar. The observer is very neat, careful, and accurate in his work, and the observatory in thoroughly good order. The observer deserves much credit for this, more especially as the station has hitherto been beyond the range of inspection by the Bengal Meteorological Office.

Bankipore—Was inspected on the 23rd of November 1883. No change has been made in the observatory since my last visit. It was found to be in the same satisfactory condition as last year.

Imperial Third Class Observatories.—These are 15 in number. Ten are situated in Bengal, one (Akyab) in Burmah, two (Silchar and in connection Tura) in Assam, and two (Gopalpore and Coconada) in Madras. The two last are maintained in connection with the Bay of Bengal Weather Service.

The following table records the superintendents and observers at these observatories during the year 1883-84:—

Stations.	Superintendents.	Observers.	Observer's allowance.
			Rs.
Darjeeling, St. Paul's School.	R. Carter, Esq., Rector, St. Paul's School, Darjeeling	Mr. W. Moore	25
Purneah . . .	Dr. Picachy	Baboo Rasick Lal Bose [1] . . ,, Rajanikanta Chackervarti [2] .	15
Durbhanga . . .	,, W. A. Gilligan	,, Jogin Chunder Banerji.* .	
Gya . . .	,, R. McLeod [3] . . . . . Baboo Benod Kishen Bose [4] . . .	Lala Nowrungee Lal . . .	15
Berhampore . .	Surgeon S. M. Shircore [5] . . . . Surgeon-Major F. C. Nicholson [6] . .	Baboo Mohendra Nath Roy† .	15
Burdwan . .	,, H. B. Purvis [7] . . . . ,, Cameron [8] . . . . ,, R. D. Murray [9] . . .	,, Mokhada Persad Chowdhry†.	15
Jessore . .	,, D. W. D. Commins [10] . . Asst. Surgeon Behary Lal Pal [11] . . Surgeon E. Bovill [12]	Baboo Poresh Nath Roy Chowdhry [13] ,, Urjoon Mahanty [14] . .	15
Dacca	......	Mr. J. S. David [15] . . . . . ,, T. W. DeSouza [16] . . . Baboo P. C. Bose [17] . . .	15

---

[1] 1st April to 31st May 1883 (transferred).

[2] 1st June 1883 to 31st March 1884.

[3] 1st April to 15th October 1883, and 23rd November to 31st March 1884.

[4] 16th October to 22nd November 1883.

[5] 1st April to 20th August and 21st November to 31st March 1884.

[6] 21st August to 20th November 1883.

[7] 1st April to 15th August 1883, and 1st to 14th January 1884.

[8] 7th August to 31st December 1883.

15th January to 31st March 1884.

[10] 1st April to 4th October, and 29th November to 31st March 1884.

[11] 5th October to 9th November 1883.

[12] 10th to 28th November 1883.

[13] 1st April 1883 to 6th February 1884, and from 20th February to 31st March 1884.

[14] 7th to 19th February 1884.

[15] 1st to 24th April 1883.

[16] 25th April to 21st December 1883, and 4th January to 31st March 1884.

[17] 22nd December 1883 to 3rd January 1884.

* Special allowances of Rs. 5 a month stopped for six months from January 1884 for neglect of duties.

† Received a special allowance of Rs. 10 a month for meritorious service.

STATIONS.	Superintendents.	Observers.	Observer's allowance.
			Rs.
Silchar	Dr. J. J. Monteith [18] „ A. H. Whitewell [19]	Baboo Romes Chandra Bhuddra	15
Demagiri	*Nil*	Asst. Surgeon Suryya Kumar Ghose	*Nil.*
False Point	*Nil*	Mr. E. Workman [20] „ J. London [21]	25
Akyab	*Nil*	„ H. J. Smythe „ R. J. Keys „ H. Vetriano	15
Tura	Civil Medical Officer	Civil Hospital Assistant	Voluntary station.
Gopalpore	Mr. A. L. Taylor, Port Officer	Mr. Goom Appala Narainhar	15
Coconada	Captain F. M. Gillham, Master Attendant	„ C. T. M. Gaetane	15

I was unable to inspect the majority of these observatories during the cold weather college vacation, which was fully occupied in visiting the Assam stations and the new or provincial third class observatories. Durbhunga, Gya, Darjeeling, and Jessore were visited by myself; Silchar by Mr. Blanford, Meteorological Reporter to the Government of India; and Dacca by my head clerk. The majority of these observatories are satisfactory in character, and the observations accurate and reliable. Two of them, I regret to state, although slightly improved, do not yet furnish observations upon which I am able to place implicit confidence. The observations sent in do not harmonize with those of the neighbouring stations, and the only possible inference I can form is that the discrepancies are due to carelessness or ignorance on the part of the observers. The observatories in question are those situated at Gya and Durbhunga. The only other explanation is that these stations possess very peculiar meteorological conditions, and that the discordance, the observations at these stations present, when compared with those of neighbouring stations, is due to a want of uniformity in nature, and not to defects in the observer or in his instruments. This solution of the discrepancy has been suggested in correspondence on the subject, but I am unable to accept it as the true solution, or to recommend it to Government as an explanation of the peculiarities in the observations at these stations.

Durbhunga Observatory—Was visited on the 25th of November 1883. The observer was absent from the station and had left his duties to be performed by a friend, without giving any intimation to the Meteorological Office. As specific orders had been given to the observer on a similar occasion (in November 1882) not to absent himself from his duties without giving the usual intimation to this office and obtaining the necessary sanction, the observer was called upon for an explanation. This was not satisfactory. The state of the observatory last year was disgraceful, and it was mainly in consequence of the observer's promise to be very careful in future, and to carry out the various regulations and orders with respect to the taking of observations diligently and exactly, that he was not deprived of his special allowance of Rs. 5 per mensem. As he has failed to comply with the clear and precise orders necessary to secure the continuity of accurate observation, I had no alternative but to recommend the Meteorological Reporter to the Government of India to withdraw his special allowance for a period of six months when he will be again permitted to draw it, if in the *interim* his observations are found to be satisfactory in character by comparison with those at neighbouring stations.

---

[18] 1st April to 3rd July and 9th October 1883 to 31st March 1884.

9th July to 8th October 1883.

[20] 1st April to 31st August, and 1st December 1883 to 31st March 1884.

[21] 1st September to 30th November 1883.

The shed was in good order and the thermometers fairly clean. The barometer was also satisfactory. The clock which was sent a few months previously was out of order, apparently due to carelessness on the part of some one, as there were signs of its having been dropped, or of its having fallen down. The wind-vane was excessively stiff, and had evidently not been oiled for months. I turned it round through an angle of 120°, and a small puff of wind which caused the anemometer to make 30 revolutions in a minute had no effect in moving it. The wind directions at Durbhunga for months past are hence, I fear, of little value. The anemometer was clean and in fair order. The observatory has improved since last year, but is by no means satisfactory; and I am unable from my continued experience of the observer's carelessness and neglect of orders to place confidence in his observations. If considerable improvement does not occur during the next year, I shall be compelled to call the attention of the Government of Bengal to the unsatisfactory character of the Durbhunga observatory.

Dacca Observatory.—My head clerk, who visited Dacca on his way to the new third class observatories in Eastern Bengal, reports as follows on the observatory at that station:—

The Dacca observatory was inspected on 13th February 1884. The barometer was in the same position as on the last inspection. The room has, however, been converted into a sitting room for the use of the Superintendent of Telegraphs of the Dacca Division, and he suggested that the barometer should be placed in another room. It was therefore decided to remove it to one of the office rooms where a suitable exposure will be provided for it. (This has since been done.)

The thermometers were in good order, but very dirty. The bulbs of the wet bulb thermometers were thickly covered with encrustation. The observer was instructed how to keep them clean for the future. The receiving bottle in the raingauge was found to be full of dust. There was a depth of at least a quarter of an inch of earthy matter collected at the bottom.

The anemometer and wind-vane worked well. They were clean and properly oiled.

The observer takes his readings accurately. The want of cleanliness in the thermometer shed is a fault which should be remedied. An observer who is interested in his work will always be careful to keep every instrument he uses as clean as possible compatible with the conditions of observation; and want of cleanliness is an almost unfailing evidence of carelessness and inaccuracy of observations.

Provincial Third Class Observatories.—These are the additional observatories established in accordance with the extended system sanctioned last year, and maintained from the Provincial Meteorological grant. They are 22 in number. The names of the superintendents and observers at these stations are given in the following table:—

Provincial Third Class Observatories.

Stations.	Name of Superintendents.	Name of Observer.	Observer's allowance.
			Rs.
Balasore . . .	J. H. Apjohn, Esq., Executive Engineer .	Baboo Radha Mohan Dass, Head Clerk	10
Midnapore . . .	Major A. D. McArthur . . .	Mr. Benjamin Augier . . .	10
Ranigunge . . .	......	Baboo Sreeram Chunder Ghose, Civil Hospital Assistant.	10
Noakholly . . .	*Nil*	Baboo Benod Behary Paul, Supervisor, Public Works Department.	10
Burrisaul . . .	*Nil*	Baboo Hemcanto Deb, Overseer, Public Works Department, aided by Sub-Overseer.	10
Serajgunge . . .	*Nil*	Baboo Heralal Seal, Telegraph Master	10
Commillah . . .	*Nil*	„ Nobin Chunder Biswas, Supervisor, Public Works Department, aided by Sub-Overseers.	10

Provincial Third Class Observatories—continued.

Stations.	Name of Superintendents.	Name of Overseer.	Overseer's allowance.
			Rs.
Furreedpore	*Nil*	Baboo Kadar Nauth Roy, Overseer, Public Works Department.	10
Mymensingh	Baboo Rakhaldas Chatterjee, Assistant Engineer.	Baboo Bamacharan Bose, Sub-Overseer	10
Rampore Beauleah	Executive Engineer	,, Gopal Chunder Chatterjee, Head Clerk.	10
Dinagepore	Executive Engineer, Julpigoree Division	,, Behary Lal Banerjee, Overseer	10
Rungpore	Ditto ditto ditto	,, Dijobar Goopto	10
Julpigoree	Baboo Madhub Chunder Roy, Executive Engineer, Julpigoree Division.	,, Woomanath Moitro, Head Clerk	10
Bhagulpore	T. Beaty, Esq., Executive Engineer [1] D. F. Martin, Esq., Executive Engineer [2]	,, Jogut Chunder Bhadhary, Head Clerk.	10
Chupra	*Nil*	,, Kaliprosanna Moitra, Sub-Overseer.	10
Motihari	Baboo Durga Charan Chackravati, Assistant Engineer [3] Mr. J. Butler, Assistant Engineer [4] Mr. C. J. Clarke [5]	Baboo Rajendra Nauth Biswas, Sub-Overseer.	10
Buxar	Executive Engineer	Baboo Boycontonath Guho	10
Arrah	Executive Engineer	Mr. T. Webb	10
Dehree	Executive Engineer, Dehree Workshops	Baboo Tulsi Das Roy, Supervisor [6] ,, Peary Lal Sen, Assistant Surgeon [7]. ,, Poorno Chunder Purkait [8]	10
Nya Doomka	Dr. R. A. Barker, Civil Surgeon, Sonthal Pergunnahs.	,, Dwarkanath Mookerjee	10
Ranchee	*Nil*	,, Peary Mohun Banerjee, Overseer	10
Chyebassa	The Head Master, Zillah School	,, Motilal Sarkar, 3rd teacher, Zilla School.	10

As the orders of the Government of India sanctioning the proposals of the Government of Bengal for the extension of meteorological work in Bengal were not received until the middle of March (Revenue and Agricultural Department No. 17 Meteo., dated 13th March 1883), it was not possible to arrange that the sheds should be built and the work of observation commenced by the date originally proposed, *viz.*, 1st April 1883.

My college duties prevented my visiting the various stations to select the sites for the observatories; it was therefore necessary to leave this to the judgment of the Public Works officers. Instructions were communicated to them, and in the great majority of cases excellent sites were chosen. In some few instances difficulties of various kinds prevented the utilization of the most suitable site selected by the Public Works officers. In these cases sites more or less inconveniently situated and badly exposed were necessarily chosen. The observatories erected on these sites will, as the value of the extended meteorological system is recognised, I feel confident, be permitted to be removed to more suitable positions than they at present occupy.

---

[1] From 4th June to 22nd July 1883.
[2] ,, 23rd July to 31st March 1884.
[3] ,, 30th May to 3rd December 1883.
[4] ,, 1st January to 8th February 1884.
[5] ,, 9th February to 31st March 1884.
[6] From 1st April to 14th May 1883.
[7] ,, 15th May to 28th November and 10th February to 31st March 1884.
[8] ,, 29th November to 9th February 1884 (Baboo P. L. Sen on leave).

I deemed it advisable to spend a considerable part of the college vacation in visiting these observatories to ascertain the condition of exposure of the instruments and to remedy any defects that might have arisen in the construction of the sheds, arrangement of the instruments and the methods of observation. The sites, it should be remembered, were selected by Public Works officers in accordance with instructions issued from this office. and the work of observation carried on by Overseers or Sub-Overseers of the Public Works Department who had received no previous training, and merely carrying out as they best could (frequently with the assistance of the Assistant Engineers or Executive Engineers) the methods and instructions as described in the *Vade Mecum.* The results, as will be seen from the following reports on the stations visited, were very much more satisfactory than I expected. A few defects were observed, but in the great majority of cases the work of observation was performed quite as satisfactorily and accurately as at the third class stations. The reports are given in the order of place and not in the order of time of inspection.

Ranigunge Observatory—Was inspected twice during the year. The observatory is attached to the subsidiary jail, the hospital assistant who is in charge of the jail taking the observations. The shed is erected in a large open space enclosed by the jail walls, and is constructed in accordance with the standard plan. The walls enclosing this compound are from 6 to 10 feet high, and are at distances varying from 20 to 60 yards from the shed. The instruments were in good order. The raingauge is placed in the open near the observatory shed, at a distance of about 10 yards.

The barometer is kept in the office room, and is in good light.

The wind-vane and anemometer are placed on the roof of the office room, and are well exposed, as they are on the highest part of the jail buildings, which are on the highest ground in the station, and at a considerable distance from large trees.

The observer had some difficulty in learning to read the barometer and anemometer correctly. He was not able to procure any assistance in Ranigunge, nor was he able to leave his post to come to Calcutta for a course of instruction at the Alipore observatory. Hence my two visits were chiefly spent in teaching him to read these instruments correctly.

The observer appears to be careful in his work and willing to do his best. The observations have been during the latter part of the year fairly satisfactory and trustworthy.

Noakholly Observatory.—The Noakholly observatory was inspected by my head clerk on the 6th February 1884. The shed is in the circuit-house compound, and is generally built in accordance with the standard plan. The eaves were found to be 2½ feet higher than they ought to have been. The instruments were in good order. The anemometer worked very heavily. On examination it was found to be defective. The teeth of the cog-wheels were worn away. The instrument was returned to Calcutta and replaced by another.

The observations at Noakholly have hitherto been taken by the Overseer, who is frequently obliged to leave the station on duty; there have hence been frequent breaks in the observations. The Magistrate suggests certain changes, which will, if carried out, secure continuous observations. He proposes that the shed be removed to the jail compound (in which there is a very large open space where it would be conveniently placed) and that the anemometer and wind-vane be placed on the roof of the collectorate and the barometer in one of the rooms of the Collector's cutcherry (*viz.*, the Collector's waiting-room). If this were done, the civil hospital assistant, who is in charge of the jail dispensary, would be able to take the observations, and as he is very intelligent and lives in quarters in the jail, his appointment as observer would secure regular and continuous, and in the opinion of the Magistrate, accurate and trustworthy observation. The changes suggested by the Magistrate will therefore, if possible, be carried out.

Burrisaul Observatory—Was inspected by my head clerk on the 31st January and 1st February 1884. The observatory is situated at a distance of about one and a half miles from the circuit-house bungalow and close to the Burrisaul river. To the south of the observatory shed, at a distance of about 250 feet, is the depôt for the night-soil of the district jail prisoners (numbering 500). The site is objectionable on this and other accounts. The ground is low. The site is near the river, and during the rains, when it is full, the water overflows and reaches within 50 or 60 feet from the shed. There is also a large tope of mango and other trees at a short distance to the south-west. The site is open in other directions. The barometer is, however, kept in the Public Works Department inspection bungalow, at a distance of one and a half miles from the shed, and a single set of observations hence requires two observers, one to read the barometer and the second the remaining instruments. The shed was originally erected in the circuit-house compound, but was removed by the orders of the Commissioner according to information received by the Inspector.

The Magistrate suggested its retransfer to its previous site, where it would be near to the room in which the barometer is kept, and also to the Public Works offices in which the observer is employed.

The instruments were found clean and in good order. The wind-vane and anemometer are placed on posts about 10 feet high. The barometer is kept in the Public Works Department inspection bungalow, and was found to be in good condition. The Public Works Department Overseer, who has taken the observations since the establishment of the observatory, takes much interest in his work and reads the instruments carefully and correctly.

Serajgunge Observatory—Was inspected by my head clerk on the 20th, 21st, and 22nd February 1884. It is situated in the grounds of the Telegraph Office close to the circuit-house bungalow. The district is low and flat. The soil is sandy and very porous, and dries rapidly after rain. In the rainy season the whole district is flooded.

The observing shed is well built, and is of the standard pattern, but of dimensions slightly different from those in the *Vade Mecum*. The whole structure stands on masonry work two feet eight inches from the ground. This was necessary as the ground is covered with water during the rains to a depth occasionally exceeding one foot and a half. The eaves of the shed being so high from the ground, the sun and rain strike inside the shed. The cage was found to be shaky. This has since been made right. The barometer is kept in the signal room of the Telegraph Office, which is a thatched shed. There is no pucca Government building near the Telegraph Office where the barometer can be placed. The instrument is in good order.

The cage instruments are in good order, excepting the wet thermometer, the bulb of which was partially covered with encrustation. This was owing to the use of well water for the reservoir. The observer was cautioned against the use of any water except rain and distilled water, and in their absence well boiled water.

The raingauge requires to be embedded in masonry work at least one foot high to protect it from being flooded over during the rains. The observer did not know that he had to use the receiving bottle for the gauge. It was kept aside in a godown. His attention was drawn to the chapter in the *Vade Mecum* on "Raingauge."

The wind-vane and anemometer are placed on the roof of the sub-collectorate, a one-storied building about 15 feet high. The instruments are reached by a strong ladder, and are at present fixed on two small blocks of wood on the parapet of the roof; but they are likely to be blown down. The observer has therefore been asked to submit an estimate of the cost of erecting masonry pillars on which to place the instruments as directed in the *Vade Mecum*. It is proposed to erect a block of two-storied buildings for the collectorate, and when they are completed the wind-vane and anemometer might be removed to the top of the new building, which will give a good exposure for the instruments.

The level of the barometer has not yet been determined for want of a datum level, the nearest bench-mark being several miles off from the station.

The observer takes much interest in his work, and records his observations very accurately.

Commillah Observatory—Was inspected by my head clerk on the 9th February 1884. The station is situated on level ground. Throughout the district are scattered numerous large tanks.

To the north-east rise the Tipperah Hills, which are visible from Commillah in clear weather, and form a prominent feature in the landscape. The river Goomtee passes to the east of the station of Commillah at a distance of about half a mile, and to the west the Megna, a deep and very broad stream.

The barometer is kept in a room of the road cess buildings and is in good order. The thermometer shed is erected on the western edge of a large tank, at a distance of about 10 feet from the edge of the water. It is well built and in good order. Except on the side towards the tank, it is surrounded by a fence at a distance of about 30 feet from the shed. The maximum thermometer was found to be out of order, and another was called for by telegram. The wind-vane and anemometer were originally placed on the roof of the collectorate, at a distance of about 150 feet from the room containing the barometer and 300 feet from the thermometer shed. The anemometer was returned to Calcutta as defective in August 1883. The roof of the collectorate is, however, not a very suitable place for the wind-vane, as it is a low one-storied building surrounded by tall trees, many double the height of the building. Hence the wind observations are not taken under satisfactory conditions, and it may be desirable to erect the wind-vane and anemometer on posts or pillars in the open ground near the thermometer shed.

The observations are taken by the supervisor and two sub-overseers of the Public Works Department, and have been accurate and satisfactory in character from the commencement. The shed is neatly constructed and the instruments very clean and in capital order. The condition of the observatory generally reflects very great credit on the supervisor.

Mymensingh Observatory—Was inspected by my head clerk on the 25th, 26th, and 27th of February 1884. The town is situated on the west bank of the Brahmaputra river, which runs as a shallow broad stream (during winter) with high banks. The whole of the district is level and open, with the exception of the Muddapore jungle, which lies to the south-west, comprising an area of about 45 miles in length by 6 to 16 miles in breadth. This part is slightly elevated, averaging in height some 50 to 60 feet above the general level. The district is also intersected by many small rivers.

The observatory is situated in an open field close to the zillah and vernacular schools, the collectorate, and the Public Works Department offices. The shed is of the standard pattern and well built. The ventilating hole required to be replaced by a section of a bamboo as directed in the *Vade Mecum*. The site is open, but being near the play-grounds of the two schools, the instruments are subject to interference from the boys. There is a bamboo fencing round the shed, but it does not appear to be strong enough to keep off mischievous boys. It is desirable therefore to have a strong wooden fence round the shed with a small gate for entrance, which should remain closed against outsiders.

The barometer is kept in an office room of the Public Works Department, and well placed. The instrument is in good order. The height of the mercury in the cistern of the barometer above sea level has not been determined for want of a datum level. The observatory was without the hygrometers. They were reported to have been broken by some of the boys of the neighbouring schools. The maximum and minimum thermometers were properly exposed and were in good order. From a local investigation of the circumstances attending the breakage of the thermometers, the head clerk ascertained that the mischief was due to one Rajendro Kissore Roy of the 4th class of the Hardinge School, who was willing to pay for new instruments. The head master was asked to recover from the boy ₨20—the cost of the thermometers—and pay it into the treasury.

The wind-vane and anemometer are placed on two pillars on the top of the turret clock-tower in the collectorate, 52 feet high. The position is quite open and equal to that of the Alipore observatory. The rod of the wind-vane (Adie) was found to be slightly bent; this was (as reported) owing to the injury it had received during transit to Mymensingh. The instruments worked well and were found to be well oiled. The raingauge is well placed. The fence was a little too near. It has been removed further off.

The observer reads his instruments correctly. The Assistant Engineer takes great interest in the proper working of the observatory, and has trained the observer (a sub-overseer) well. The Public Works Department is providing a ladder to reach the top of the clock-tower.

Furreedpore Observatory—Was inspected by my head clerk on the 16th of February 1884. The shed is situated in the centre of a fairly large open maidan near the police lines, and at a short distance from the circuit-house.

It is well and strongly built, but, through some oversight, not exactly in accordance with the Bengal pattern. The chief defects were that there was no ventilating hole in the roof to permit the escape of heated air, and that the eaves were somewhat too high. These defects have since been remedied.

The thermometers were generally in very fair condition. The wet bulb was covered with a thickish encrustation in consequence of the use of tank water instead of rain water. The barometer is kept in a room in the jail building, and was found to be in good order. The raingauge is placed near the observer's home at a distance about half a mile from the shed, and was in good order. The wind-vane and anemometer were erected on a platform supported by posts with a bamboo ladder to reach them. The latter instrument was somewhat dirty. It was hence taken down and cleaned, and the observer instructed in the method of cleaning and oiling it.

The observer read the instruments correctly and takes much interest in his observations, which have been on the whole very satisfactory during the year.

The only defect in the observatory is that the instruments (barometer and raingauge) are situated at considerable distances from one another and the shed, and also from the house and office of the observer. My head clerk suggested the removal of the shed to a position in a field belonging to the municipality. I have, however, not thought it advisable to make any change at present, as the observations under the present system seem to be quite trustworthy and taken at the proper hour daily, and the removal of the observatory from one part of a station to another, to suit the convenience of the observer, would speedily do away with uniformity in the conditions of observation and registration.

Rampore Beauleah Observatory—Was inspected by my head clerk on the 10th and 11th January 1884. The observatory is situated near the Executive Engineer's office at about a mile and a half from the city. The river Ganges (Padma) flows as a deep wide stream to the south of the observatory at a distance of about 500 feet from the shed.

The barometer is kept in a room in the Executive Engineer's office. It was in a bad position as the light came directly from the front. The instrument has since been removed to a better and more secure position in the same room. The sea level height has not been affected thereby.

The thermometer shed is of the standard pattern, but the air hole on the top of the shed instead of being a ventilating pipe was found to be of the form of an elliptical hole (about 2 feet by 1½ feet) permitting the sun's rays to enter at certain hours of the day, and affecting the thermometric readings. This has been remedied.

The thermometer cage instead of being set upon the southern pole in the shed had been fixed by means of two additional posts in the middle of the north and the south poles supporting the ridge. The observer was asked to set it in the proper place.

The thermometers were in good order with the exception of the wet bulb hygrometer. The bulb of this instrument was found to be completely coated with a thick deposit, and the muslin had evidently not been changed for some time, as it was very dirty. The muslin was removed. Instructions for keeping the instrument in order were also given to the observer.

The anemometer and wind-vane are placed on the terrace roof of the Executive Engineer's office, and appear to be in a satisfactory position. There are several high trees to the north and north-east of the building at a distance of about 100 or 150 feet from it, but they probably do not influence the wind direction to any appreciable extent. The anemometer was full of dirt and appeared to work with much friction. It was taken down, cleaned and oiled and reset in position, and the observer instructed to keep it clean in future.

The raingauge is in the garden compound of the Executive Engineer. The mouth of the funnel was not level. The funnel hole was completely choked up by dirt and earth. The rain receptacle was also far from being clean.

The observer read the instruments well.

Dinagepore Observatory—Inspected by my head clerk on the 8th January 1884. It is situated near the circuit-house in a fairly open space, but on low ground. The river Poonarvava flows to the west and north-west of the observatory at a distance of about one-fourth of a mile.

The barometer is placed in a brick-built store-room of the Public Works Department, and is in good light. The instrument was clean and in good working order. The shed is entirely of bamboo work, but strong and well thatched, and laid out according to the standard plan.

The thermometers are all properly exposed and in very good order. The anemometer and wind-vane are placed on the terrace of the Judge's court-house at a distance of about 725 feet from the thermometer shed. To the north and north-west of the building, at a distance of 100 to 140 feet, there are several large trees which overtop the instruments on the terrace. The instruments were in good order.

The raingauge is well placed, but the fencing was too near the instrument. The observer was instructed to remove it to a further distance, and this has since been done.

The observer is a subordinate of the Public Works Department. He appears to take great interest in his work, and reads the instruments correctly.

Rungpore Observatory.—The station of Rungpore is in the plains of Northern Bengal on low flat land between the rivers Teesta and Cosi. The observatory is erected on a large open maidan near the Collector's cutchery. The ground is somewhat low and apt to be flooded during heavy rains. The barometer is kept in an out-room of the Collector's court, and is conveniently situated in a good light.

The thermometer shed is situated about 100 feet to the north-west of the northern extremity of the Collector's cutchery. The post office is situated in about the same distance to the west; with the exception of these two buildings, the ground in the neighbourhood is very open and quite free from trees. The shed is very well built and was clean, and the instruments in satisfactory working order.

The anemometer and wind-vane are erected on the school-house—a building about one-fourth of a mile to the south of the observatory. The building is a lofty one, and the instruments are placed on small brick pillars, and are thoroughly well exposed. They are approached by substantial ladders.

The observatory is well built and the observations trustworthy. It reflects much credit on the Assistant Engineer who selected the site and superintended the erection of the observatory and the commencement of the work of observation.

Julpigoree Observatory—Inspected on the 6th January 1884. The observatory is situated on a large open maidan near the Executive Engineer's office and within a few minutes' walk from the railway station. The site is open, as the nearest trees and buildings are at a considerable distance. The river Teesta flows past the station at a distance of about half a mile to the east and north-east of the observatory. The banks of the river are low, and the district is alluvial.

In the absence of any brick building near the observatory, the barometer is kept in a thatched godown belonging to the Public Works Department walled by thick *durma* mats all round. It is in fair light and in good working order.

The shed is constructed of bamboo on the pattern laid down in the *Vade Mecum.* It is neatly and strongly built. The thermometers are in good order. The raingauge is well placed and free from any obstruction in all directions.

The anemometer and wind-vane are placed on a wooden platform 18 feet high, supported by poles with ladders to reach them. The vane is correctly set. The anemometer worked somewhat heavily and had evidently not been cleaned or oiled since its erection. It was taken down, cleaned, oiled, and reset in position, and the observer instructed how to keep it clean and in good working order. The head clerk of the Executive Engineer's office is the observer. He reads the thermometers correctly, but was doubtful and slow about the barometric and anemometric readings. Fortunately the Executive Engineer is much interested in the observatory, and frequently takes the barometric readings, so that the barometric observations hitherto taken have generally been satisfactory.

The observer was drilled for some time in reading the two instruments with fairly satisfactory results.

Bhaugulpore Observatory—Inspected on the 17th and 18th November 1883. The observatory is situated in the compound containing the dispensary and the Assistant Surgeon's quarters. It is on fairly open ground and well situated. The barometer is kept in a room of the dispensary, and is placed in a satisfactory light. The anemometer and wind-vane are both erected on the roof of the dispensary, and are reached by strong ladders. There are numerous trees in the neighbourhood, but they are at some distance away, and do not influence the readings of the wind-gauging instruments. The observatory is fairly good as to situation : the instruments well placed and in good order. The observer is also head clerk to the Executive Engineer, and is apparently both accurate and careful in his work.

Chupra Observatory—Was inspected on the 5th and 6th of December 1883. The station is situated on the northern bank of the Ganges, and is in the midst of a flat, well cultivated alluvial district. The observatory shed (well fenced in) is erected in the compound of the circuit-house bungalow, in one of the rooms of which the barometer is kept. The shed is neatly and strongly built in accordance with the Bengal pattern, and was found in very good order. The thermometers were all in good order, except the wet bulb, which, on examination, was found to be wrongly graduated. This defective instrument had apparently been issued without due examination by some oversight in both the Bengal and India offices. The readings of the wet bulb for the preceding months are hence entirely wrong, and the deduced humidity values of this station published in the Bengal daily weather reports during last year incorrect and misleading. A new wet bulb was sent very shortly afterwards to replace this defective instrument.

The wind-vane and anemometer are erected on the roof of the road cess offices. They are about 30 feet from the ground, and the neighbourhood is fairly open and free from large trees, so that the exposure is satisfactory.

The raingauge is kept in the compound of the same buildings. The distance between the circuit-house bungalow and the road cess offices is between one-fourth and half of a mile. This separation of the wind-recording instruments is not very satisfactory, but I was unable to propose any other arrangement, as it is very difficult to obtain a good exposure for wind-vane and anemometer in a mofussil station.

The instruments were all in good order, and the observer was accurate in his readings.

Motihari Observatory—Inspected on the 21st and 22nd November 1883. The station is in the Chumparun district, and is situated in a level alluvial district about 20 miles to the east of the river Gundack. The observatory is placed on a large maidan or open space between the new collectorate offices and the railway. There are no trees in the neighbourhood, as the new collectorate buildings have been erected at some little distance from the old station, and hence its exposure is much more open than in the case of the majority of our stations, and represents more closely the atmospheric conditions of the surrounding district than is usually the case. The shed is very substantially and neatly erected. It is enclosed at some distance by an open latticework which allows complete circulation of the air, but prevents admission to the cattle which pasture on the maidan. The thermometers were all clean and in good working order except the maximum in shade, which had apparently reached the observatory in a defective condition. (It was replaced by a correct instrument.) The barometer is kept in the Collector's waiting-room. The light is good, and the instrument in efficient working order. The anemometer is placed on one of the highest points of the collectorate buildings in capital position. The wind-vane has been for the present placed on the top of the central pole of the shed, and is reached by means of a ladder reclining on the roof of the shed. This is the only instrument that is not satisfactorily placed, and it would be very desirable to have the wind-vane placed on the top of the collectorate building in the position which I pointed out to the sub-overseer and observer. Strong ladders should be provided to enable the observer to mount to the roof of the collectorate with comfort and rapidity.

The observatory is in a very satisfactory state, and reflects much credit on the observer.

Buxar Observatory—Inspected on the 7th December 1883. The observatory at this station is in the fort. The interior of the fort is considerably elevated above the surrounding ground. At a short distance to the north of the fort the Ganges flows past. The river here has the same character as at Benares. It flows as a deep stream between highish banks. The southern bank appears to be the higher at Buxar. There is no wide stretch of sand through which the river flows, as is the case in the lower reaches of the river. The only building in the fort is the office and residence of the Executive Engineer of the Buxar Canal. The barometer is kept in a room of the office and is in a very good light. The shed is erected in a small depression in the mud wall enclosing the fort, and is well exposed. The instruments were very clean and in good order. The wind-vane and anemometer are erected in one of the corner bastions, and are thoroughly well exposed and in perfect order. The observer reads the instruments carefully and correctly. The observatory is in very satisfactory order, and the observations of high value for accuracy.

Arrah Observatory.—Was inspected on the 4th and 5th December 1883. The observatory is in the compound of the office of the Superintending Engineer of the Sone Canals at a short distance from the railway station. The site is fairly open. The shed is strongly built, and is in very good order. The barometer is placed in a large office room and is in a capital light. The thermometers were all in good order, except the minimum in shade, the column of which had given some little trouble from its tendency to break. The observer was taught how to remedy this defect. The raingauge is in open ground near to the observatory. The wind-vane and anemometer are on the roof of the building, and are well exposed. The observatory is very satisfactory, and the observer accurate and careful in his work.

Dehree Observatory—Was inspected by my head clerk on the 22nd March 1883. It is situated in the Dehree Workshop dispensary compound. The shed is very old and shaky, and the thatching is thin and worn-out. The instruments in the cage were not set according to the approved standard regulations. They were correctly placed. There should be a fence round the shed. The barometer is placed in a room in the dispensary building, and was found in good order.

The thermometers were clean and in good order. The minimum thermometer was found to have some cotton stuffing inside the hole on the wooden board near the bulb. This has since been removed. The presence of the cotton stuffing quite close to the bulb may have slightly affected the minimum thermometer readings of the past months.

The anemometer and wind-vane are set up on the top of the dispensary bungalow. They are reached by a strong ladder and a flight of steps on the sloped roofing. The instrument is fixed to the upper end of a gas pipe five feet high, and is hence shaken by the slightest wind. The wind-vane (Adie) is placed close to and on a level with the cups of the anemometer, and is kept in continual motion by the rotation of the anemometer. As an effect of the shaking the pivot screw nut on the back of the dial wheels of the instrument had been thrown off from the worm of the screw and lost. The observer was asked to have the nut replaced from the workshops. Other instruments were found to be quite satisfactory.

Baboo Peary Lall Sen, Assistant Surgeon, is the observer. He reads the instruments fairly, and takes much interest in his meteorological duties.

Nya Doomka—Is situated in the Sonthal Pergunnahs at an elevation of about 500 feet in the midst of the broken country between the plains of Southern Behar and the Gangetic Delta. The station itself is situated on fairly level and open ground, but in its neighbourhood there are many low hills more or less wooded.

The observatory shed is in the compound of the dispensary. The shed was erected according to the pattern plan under the supervision of the Civil Surgeon, and is well built and in good order. The instruments were properly exposed and in satisfactory condition. The barometer is well placed in the office room of the Civil Surgeon.

The raingauge is placed at a short distance from the shed. The wind-vane was erected on the top of a pole about 16 feet high, and was read from below. The anemometer was not in position, as there is no proper building near the dispensary with a flat roof on which to erect the wind-vane and anemometer. I have since my visit sanctioned the erection of a brick pillar with a brick staircase for the accommodation of these instruments.

The observatory is in very satisfactory order, and the observer careful and accurate in his record of observations. The observatory is the only one as yet in operation in the large district known as the Sonthal Pergunnahs, and will, I trust, give observations of very considerable value. Its establishment was due to a suggestion from the Civil Surgeon, who has taken much interest in it, and made it one of the most efficient of those started last year under the new system.

Rainfall-recording stations.—There has been a slight increase in the number of rain-recording stations during the past year. In 1882-83 the number was 162, and in the official year 1883-84 it was 167. This increase is due to the establishment of the following rainfall stations :—

	Date of first sending in returns.
Naraingunge	June 1883.
Nowgong	July „
Siligoree	Do. „
Dehree	Do. „
Lohardugga	January 1884.

The returns from the great majority of these stations were received punctually and regularly. Delays occurred in the submission of the returns occasionally. The only stations which gave frequent trouble in this respect were Bagirhat (in Khoolna district) and Jagatsingpore (in the district of Cuttack). It was necessary on several occasions to call the attention of the sub-divisional officer in charge of the former station to the delay and inaccuracy in his rainfall reports.

Some of the rain-registering gauges for revenue purposes (*viz.,* at Commillah, Mymensingh, Rampore Beauleah, Burrisaul, Serajgunge) were examined by my head clerk on his visit from district to district during his inspection of the local observatories. He found in the case of every raingauge that he examined a large accumulation of dirt in the gauge and glass receiver; hence it appears to me probable that the raingauge and appendages are generally not kept as clean as they ought to be. Experience shows me that carelessness in not keeping instruments clean is frequently accompanied with carelessness of observation. I am of course not able to assert that such is the case in the rainfall-registration of Bengal. So far as I can judge from the examination of the rainfall returns, the registration of rainfall is effected with approximate accuracy, and the returns give generally consistent and continuous variations from district to district, which are the strongest proof of their correctness. In a few cases during the year they were evidently inconsistent, and probably wrong, due either to careless reading or neglect to measure the rainfall at the proper hour.

Instruments.—The following tables show the number of instruments that have been broken, or lost, or rendered unserviceable during the year 1883, at the Imperial and Provincial observatories, and of the instruments supplied to them during the year. The additional Provincial observatories, 22 in number, were finished with complete sets of instruments shortly after the commencement of the official year. These instruments were received almost without exception in good order, due mainly to the careful way in which they were packed by the Mathematical Instrument Department :—

Return of Instruments broken or otherwise injured at the Imperial Observatories in Bengal and Assam, 1883-84.

STATIONS.	Barometer.	HYGROMETER.		Dry maximum.	MINIMUM THERMOMETER.		RADIATION THERMOMETER.		Anemometer.	Wind-vane.	Raingauge.	Measure glass.	Lens.	Clock.	Sand glass.
		Dry.	Wet.		Dry.	Wet.	Solar.	Grass.							
Patna	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cuttack	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Chittagong	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...
Saugor Island	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hazaribagh	...	...	...	...	...	...	...	...	(*a*) 1	...	...	...	...	...	...
Purneah	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...

(*a*) Worn out by prolonged use.

Return of Instruments broken or otherwise injured at the Imperial Observatories in Bengal and Assam, 1883-84—(continued.)

STATIONS.	Barometer.	HYGROMETER.		Dry maximum.	MINIMUM THERMOMETER.		RADIATION THERMOMETER.		Anemometer.	Wind-vane.	Raingauge.	Measure glass.	Lens.	Clock.	Sand glass.
		Dry.	Wet.		Dry.	Wet.	Solar.	Grass.							
Burdwan	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Berhampore	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
St. Paul's School, Darjeeling	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Jessore	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
False Point	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dacca	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Durbhunga	...	...	...	...	...	...	...	1	...	...	...	...	...	1	...
Gya	...	...	(*a*) 1	...	...	(*a*) 1	...	...	(*a*) 1	...	...	...	...	...	...
Akyab	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Gopalpore	...	...	...	...	...	...	...	...	(*a*) 1	...	...	...	...	...	...
Coconada	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sibsagar	...	...	...	1	...	...	...	1	...	...	(*a*) 1	...	...	...	...
Dhubri	...	...	...	...	...	...	...	(*b*) 1	...	...	...	...	...	...	...
Cachar	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Tura	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Demagiri	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(*a*) Worn out by prolonged use. (*b*) Stolen.

Return of Instruments, &c., broken or otherwise injured at the Provincial stations in Bengal, 1883-84.

STATIONS.	Barometer.	HYGROMETER.		Dry maximum.	MINIMUM THERMOMETER.		RADIATION THERMOMETER.		Anemometer.	Wind-vane.	Raingauge.	Measure glass.	Lens.	Clock.	Sand glass.
		Dry.	Wet.		Dry.	Wet.	Solar.	Grass.							
Balasore	...	...	...	...	...	...	...	...	(*c*) 1	...	...	...	...	...	...
Midnapore	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ranigunge	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Noakholly	...	...	...	...	...	...	...	...	(*c*) 1	...	...	...	...	...	...
Burrisaul	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Serajgunge	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Commillah	...	...	...	(*e*) 1	...	...	...	...	(*e*) 1	...	...	...	...	...	...
Furreedpore	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mymensingh	...	(*d*) 1	(*d*) 1	...	...	...	...	...	...	...	...	...	...	...	...
Rampore Beauleah	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dinagepore	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...
Rungpore	...	...	...	...	(*e*) 1	...	...	...	...	...	...	...	...	...	...
Julpigoree	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bhaugulpore	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(*c*)—Defective.
(*d*)—Broken by a student of the Hardinge School, who paid for new instruments.
(*e*)—Out of order in transit.

Return of Instruments, &c., broken or otherwise injured at the Provincial stations in Bengal, 1883-84—(continued.)

STATIONS.	Barometer.	HYGROMETER.		Dry maximum.	MINIMUM THERMOMETER.		RADIATION THERMOMETER.		Anemometer.	Wind-vane.	Raingauge.	Measure glass.	Lens.	Clock.	Sand glass.
		Dry.	Wet.		Dry.	Wet.	Solar.	Grass.							
Chupra	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Motihari	(e) 1	...	...	(f) 1	...	...	...	...	...	...	...	...	...	...	...
Buxar	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Arrah	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dehree	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Nya Doomka	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ranchee	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Chyebassa	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(*f*)—One condemned as defective. (*e*)—Out of order in transit.

* * * * *

Return of Instruments, &c., issued to start the Provincial observatories in Bengal during 1883-84.

STATIONS.	Barometer.	HYGROMETER.		Dry Maximum.	MINIMUM THERMOMETER.		RADIATION THERMOMETER.		Anemometer.	Wind-vane.	Raingauge.	Measure glass.	Lens.	Clock.	Sand glass.
		Dry.	Wet.		Dry.	Wet.	Solar.	Grass.							
Balasore	1	1	1	1	1	...	...	...	(a) 2	1	1	1	...	...	...
Midnapore	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...
Ranigunge	1	1	1	1	1	...	...	...	1	1	1	1	...	1	...
Noákholly	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...
Burrisaul	1	1	1	1	1	...	...	...	1	1	1	1	...	...	..
Serajgunge	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...
Commillah	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...
Furreedpore	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...
Mymensingh	1	3	2	1	1	...	...	...	1	1	1	1	...	...	...
Rampore Beauleáh	1	1	1	1	1	...	...	...	1	1	1	1	1	...	...
Dinagepore	1	1	1	1	1	...	...	...	1	1	1	1	1	1	...
Rungpore	1	1	1	1	(c) 2	...	...	...	1	1	1	1	...	...	...
Julpigoree	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...
Bhaugulpore	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...
Chupra	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...
Motihari	2	1	1	2	1	...	...	...	1	1	1	1	...	...	...
Buxar	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...
Arrah	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...
Dehree	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...
Nya Doomka	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...
Ranchee	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...
Chyebassa	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...

(*a*) To replace a defective instrument. (*c*) One out of order in transit.

The number of instruments destroyed by accident during the year was unusually small. The Chittagong, Purneah, Durbhunga, and Sibsagar observers each broke a thermometer during the course of the year whilst handling them at the time of taking the observations. No breakages have occurred during the year at the new stations. This is partly due to the fact that they are not provided with radiation thermometers which are the most liable to damage on account of the conditions of their exposure. It, however, indicates that the new observers have been very careful of their instruments, and it is exceedingly creditable to them.

A grass radiation thermometer was stolen at Dhubri. Efforts were made to discover the thief, but without success. Two thermometers, the wet and dry bulb thermometers, were broken at Mymensingh in the month of January. Suspicion fell on one of the boys of the vernacular school, and when my head clerk was in the station inspecting the observatory, he enquired carefully into the matter. The result was that the cost of the instrument was recovered from the guardians of the boy who broke the instruments and paid into the treasury.

* * * * * *

Central Office.—The office establishment on the 31st March 1884 consisted of the following clerks:—

Baboo	Chandi Churn Chatterji,	Head clerk.
,,	Purna Chundra Mukerji,	2nd ,,
,,	Bireswar Mukerji,	3rd ,,
,,	Kamini Mohun Bose,	Tabulator.
,,	Joggeswar Roy,	,,
,,	Debendra Nath Banerji,	,,
,,	Rakhal Das Chuckerbutty,	,,
,,	Ashutosh Roy Chowdhuri,	,,
,,	Nibarun Chunder Chatterji,	,,
,,	Joti Lal De,	,,
,,	Nogendra Nath Paul,	Draughtsman.

The amount of work which had to be done in connection with the extension of the system was much larger than I anticipated, and it was therefore necessary to employ temporary clerks for some months. Four were employed from 16th May to 15th July, and three from 16th July to 15th November.

The clerks generally have assisted zealously and intelligently in carrying out the extensions, and have worked very laboriously during the past year. Baboo Chandi Churn Chatterji has, as last year, been a most efficient head clerk. I desire also to place on record my recognition of the hard and useful work done by Baboos Kamini Mohun Bose and Debendra Nath Banerji, the former of whom was in charge of the rainfall registration and tabulation, and the latter of the preparation of the Bay of Bengal and Bengal Daily Weather Reports.

The following gives a brief summary of the work done by the office during the year:—

1. The correspondence which included 1,750 letters received and 2,440 letters issued, or 4,190 letters in all docketted and filed for reference. The following table will show the very large increase that has taken place in the office correspondence consequent on the extension and the rapid rate at which the correspondence has increased during the past two years:—

Year.	Letters received.	Letters issued.	Total number.
1879	621	579	1,200
1880	672	629	1,301
1881	601	635	1,236
1882	917	1,112	2,029
1883	1,750	2,440	4,190

2. The reduction and tabulation of the 10 A.M. and 4 P.M. observations taken at seven second class stations, and fifteen Imperial third class stations, and of the 10 A. M. observations taken at twenty-two Provincial third class stations, and also of the hourly observations taken on four days of each month at the following second class stations:—

Dhubri.	Patna.
Sibsagar.	Cuttack.
Hazaribagh.	Chittagong.

3. The entry of all the observations taken previous to the year 1883 at 18 stations in Bengal in books for reference, and in such a manner that the mean pressure, maximum or minimum temperature, and rainfall for any day of the year at any of these stations can be at once obtained. These are filed in four thick folio volumes, and the observations which continue to be taken are added, so that they form a continuous record of all the observations taken at each station, arranged in the simplest way for reference.

4. The entry of all the rainfall observations taken at the revenue stations filed in the office records into twenty-four large folio volumes in a similar manner to the preceding, so that the average rainfall for any day, or any week or month, or any other portion of a year, may be determined with the least possible labour.

5. The preparation of the Bengal daily weather report, from 15th May to 6th of November, and of the Bay of Bengal weather report during the year.

6. The preparation of the weekly and monthly meteorological and rainfall reports for the province published in the *Calcutta Gazette*.

7. The preparation of four sets of three rainfall charts monthly during the south-west monsoon period, 1883 (*i.e.*, from May to November), showing by colours—

(1) the average distribution of rainfall over the province for the month;
(2) the actual distribution of rainfall for the same month;
(3) the variation of the actual from the average rainfall, indicating whether it was in excess or defect, and the amount.

The four sets were all drawn and coloured by hand. One set was forwarded about the 8th of the succeeding month (to that to which it referred) to His Honour the Lieutenant-Governor; a second set to the Secretary to the Government of Bengal in the Revenue Department; a third to the Sanitary Commissioner; and the fourth was kept for office reference.

8. Preparation of special returns and a special set of charts, illustrating the distribution and partial failure of the rains in Bengal during the south-west monsoon period of 1883 (*i.e.*, from May 15th to November 15th). These were submitted to the Secretary to the Government of Bengal in the Revenue Department, and were referred to in the Resolution of the Government of Bengal in the Revenue Department, dated 18th December 1883, in the following terms:—" These results are shown upon charts which have been prepared by the Meteorological Reporter to this Government. The Lieutenant-Governor would have been glad had time permitted of these charts being lithographed and published with this Resolution; for an inspection of them, and a perusal of the correspondence published herewith, would have shown in a striking manner the intimate relation which exists between deficient rainfall and crop failure. In fact, it may be said that the information supplied to Government by the Meteorological Reporter suggests practically the same conclusions which an examination of the local reports dictates."

9. The preparation of tables giving the average and actual rainfall, and the difference between the actual and average rainfall (or variation) for each month of the year 1883 and for the whole year at 166 rainfall-recording stations. These returns were published in the *Calcutta Gazette* of the 30th January 1884.

Storm-signals.—No very severe cyclone was generated in the Bay of Bengal during the year 1883. A number of smaller cyclonic storms occurred during the prevalence of the south-west monsoon over the Bay. They gave rise to strong winds and stormy weather, and in one or two cases to winds of hurricane force over a small part of the Bay, more or less dangerous to any ships involved in them near the centre. The following is a list of all those which are known to have occasioned wind and sea, trying, if not dangerous, to shipping:—

1. Storm of June 13th to 16th at the commencement of the south-west monsoon, and which gave the first heavy burst of rainfall to Behar. It formed near the Balasore coast on the 13th, and advanced into Behar where it broke up on the 20th.

2. Storm of June 26th to July 4th. This was generated slowly near the Sandheads on the 26th and 27th, and was of considerable intensity, and remained nearly stationary until the 29th. It crossed the Balasore coast early on the morning of the 30th.

3. Storm of July 6th to 8th. This was formed at or near the Sandheads under similar conditions to the preceding, but was of small intensity. It crossed the Balasore coast on the afternoon of the 7th.

4. Storm of the 12th to 14th of July. This began to form on the morning of the 12th off the south Orissa coast, across which (between False Point and Gopalpore) the centre advanced on the evening of the 13th, or early on the morning of the 14th, into the Central Provinces. It was of slight intensity.

5. Storm of the 16th to 18th of August. This was formed in the north-west angle of the Bay and crossed the north Orissa coast near Balasore. This storm was very small, and of very slight intensity, and of no importance.

6. Storm of the 23rd to the 26th of August. This was generated further to the south than the preceding storm, and crossed the Ganjam coast between Gopalpore and Vizagapatam on the evening of the 25th. It was of slight intensity.

7. Storm of the 30th August to the 3rd of September. This depression crossed the coast near Balasore on the afternoon of the 2nd of September, and was of moderate intensity.

8. Storm of the 6th and 7th of September. This was formed immediately after the preceding, and followed along nearly the same track, crossing the Orissa coast to the south of Balasore on the morning of the 7th. It was of small intensity.

9. Storm of the 11th to the 15th of November. This was apparently generated in the Martaban Gulf, and advanced first in a north-westerly direction to latitude 16° N and longitude 93° 45′ E in the neighbourhood at Diamond Island, and then recurved slightly and moved northwards parallel to the coast and broke up in the neighbourhood of Akyab during the afternoon of the 14th. This was the most severe and intense storm of the year in the Bay, but was of very limited extent, and hence did not apparently affect the weather in the north-west angle of the Bay.

10. Storm of the 2nd to the 4th of December.

The above list of storms for the year 1883 presents two important peculiarities, which are both illustrations of generalizations and deductions, to which attention has been called in my cyclone reports. The first is the unusually large number of small cyclonic storms during the period when the south-west monsoon was in force at the head of the Bay and in Bengal. The south-west monsoon of last year was unusually weak, and terminated abruptly in the latter part of September. A weak monsoon is usually accompanied with heavier rainfall than usual near the head of the Bay, and with the consequent formation of a larger number of cyclonic storms or atmospheric whirls. The past south-west monsoon has apparently been a well marked illustration of this principle. The other important feature was the absence of storms during the period extending from the 15th of September to the 10th of November. After the abrupt termination of the south-west monsoon in Northern India, north-easterly winds set in almost immediately on the Coromandel Coast and gave heavy rain for several weeks, so that the commencement of the north-east monsoon in Madras last year was one of the most favourable for agricultural operations which that presidency has experienced for some years. Heavy continuous rain on the Madras coast during the October transitive period is, as indicated by the condensation theory of cyclones, unfavourable to the formation of cyclonic whirls on the Bay at that time. Experience confirms this, and indicates that a strong north-east monsoon on the Madras coast, with heavy and more or less continuous rain over the land, is associated with an absence of cyclones in the Bay. The past year was a remarkable example of this principle. The October transition period was characterised by unusually fine weather in the Bay, and by the non-occurrence of a single storm until the 11th of November, when rainfall ceased for some time in the Madras Presidency.

Nine of these storms, *viz.*, Nos. 1, 3, 4, 5, 6, 7, 8, 9, and 10, although giving strong winds and a high sea at Saugor Island, did not appear to be of sufficient intensity to warrant the hoisting of storm signals. Warning signals were hoisted for storm No. 2 only.

On the approach of this storm, bad weather signal No. 6 was hoisted at 11-30 A.M. on the 28th June, intimating that a small cyclonic storm was formed near the head of the Bay. This was changed on the receipt of further telegraphic weather reports to signal No. 8, at 1 P.M. of the same day, intimating that the storm was advancing from the Bay to the coast on the west of the Hooghly, or between Saugor Island and False Point. The storm signals were taken down at 2 P.M. on the 30th.

Daily Weather Reports.—As stated in my last report, the form of the Bay of Bengal daily weather report was altered at the commencement of the official year. The size of the sheet was reduced, a better quality of paper was used, and a chart and form lithographed for it at the Lithographic Department of the Surveyor General's Office. The new form of report was first issued on the 15th May. The character of the report was not altered, but advantage was taken of the establishment of an observatory at Balasore to increase slightly the number of the stations sending observations for this report. The report now furnishes observations taken at 17 stations on or near the coast of the Bay, together with a summary of the more important features of the weather as indicated by the observations, and a chart giving the distribution of pressure, air motion, and rainfall. This report was supplied to 29 subscribers and 30 Government officials at the commencement of the year, and to 29 subscribers and 32 Government officials at the end of the year. The receipts from subscription during the year covered the cost of printing and distributing the reports. There was a small balance of Rs. 160-5-6 at the end of the year 1883-84, which was kept in hand in order to meet any repairs to the lithographic presses.

The Bengal daily weather report was first issued on the 15th of May. The first reports gave observations taken at 14 stations, with a short summary. The number of stations was gradually increased by the establishment of the additional observatories, and from the beginning of August daily weather telegrams were received from 31 observatories, including 4 in Orissa, 6 in South-West Bengal, 4 in East Bengal, 6 in North Bengal, 4 in North Behar, 6 in South Behar, and 1 in Chutia Nagpur.

These reports were published and issued by the Bengal Secretariat Press, and were supplied to 94 Government officials and to 3 subscribers.

Copies of the weekly and monthly meteorological and rainfall returns (as published in the Gazette) were struck off for the convenience of the public, and were supplied at a charge just sufficient to cover the actual expense of printing and distribution.

Marine Meteorology.—A fair amount of work has again been done in this Department. In consequence of the unusually heavy work thrown upon me during the past year in carrying out the extensions required for the Bengal Government, and of my absence for three months on privilege leave, I was not able to do as much as I desired. Mr. Dallas has continued to work steadily at the charting of the barometer and wind data of the Bay, and has finished this work up to the month of June. Two hundred and fifty-three sets of returns, giving meteorological extracts from logs, were sent in to me by the captains of vessels arriving in the port. The officers of several steamers bolonging to lines trading between Calcutta and England take special observations in the Bay and Arabian Sea on their way home and back again. Log-books have been sent to me on several occasions with permission to make any extracts that were required.

The results of the working of the past two years has shown, it seems to me, conclusively that a large amount of valuable meteorological information can be easily obtained from the captains of vessels navigating the Bay, and that the majority of captains and officers of vessels, from the interest they take in the weather, are ready, even at considerable trouble to themselves, to fill in the returns in the hope they may be of some use in the investigations of the Meteorological Department.

Although the number of returns sent in is smaller than were received last year, they have been of higher quality. A fair proportion of the observations have been as accurate and carefully taken, judging from internal evidence and from a comparison with the land observations on the coasts of the Bay, as at our best land observatories.

I have utilized the information they have supplied in preparing an account of the two most severe storms in the Bay during the year 1883, *viz.*, that at the head of the Bay in the last week of June, and that off the Burma and Arakan coast in the second week of November. It is intended to publish this and the cyclone reports which were nearly finished last year, during the present year.

In addition to the information derived from the meteorological extracts from the logs of vessels, meteorological observations were taken at 10 A.M. and 4 P.M. on board the light vessels near the mouth of the Hooghly.

The following gives the names of the vessels at which observations were taken, and the period during which they were recorded :—

	Station.	Period.
Floating Light Vessel "Star"	Eastern Channel	April 1883 to 30th March 1884.
" "Meteor"	Intermediate Station	April to 8th October 1883.
	Mutlah Station	November 1883 to March 1884.
" "Foam"	Long Sand Station	September and October 1883, March 1884.
" "Comet"	Upper Gasper	April to November 1883.
" "Mermaid"	Lower Gasper	April to October 1883.
	Intermediate Station	February 1884.
" "Planet"	Pilot Ridge Station	10th July to 19th September 1883.
	Intermediate Station	9th October to 30th November 1883.
	Upper Gasper	1st December 1883 to 31st January 1884.

Financial Statement.—The following gives the expenditure on account of the Bengal Meteorological Department during the year 1883-84, and the total grants sanctioned by Government under each of the various heads :—

Heads of Expenditure.			Actual expenses incurred during 1883-84.	Budget grant for 1883-84.
		Rs.	Rs. A. P.	Rs. A. P.
Meteorological Reporter's allowance		3,600	5,400 0 0	5,400 0 0
" Marine		1,800		
Office establishment	Permanent		4,526 6 3	4,851 0 0
	Temporary		400 15 5	400 15 5
Office rent			900 0 0	900 0 0
Observers	Telegraph Masters		2,100 0 0	9,240 0 0
	Native Observers		4,440 0 0	
	Provincial Observers		2,131 4 10	
Messengers' allowance			62 14 5	100 0 0
Allowance to Superintendents of observatories			1,440 0 0	1,440 0 0

HEADS OF EXPENDITURE.	Actual Expenses Incurred during 1883-84.	Budget Grant for 1883-84.
	Rs. A. P.	Rs. A. P.
CENTRAL OFFICE.		
Contingent and office furniture	792 9 0	1,140 0 0
Postage	1,693 4 9	4,000 0 0
Telegraphic messages	12,199 4 0	19,000 0 0
Travelling allowances	1,423 7 0	1,780 0 0
OBSERVATORIES.		
Building and repairs	1,093 3 6	2,550 0 0
Contingent	91 7 6	98 0 0
TOTAL	38,694 12 8	50,899 15 5

The amount is Rs. 11,898-15-4 in excess of the actual expenditure of last year, but Rs. 12,205-2-9 less than the sanctioned grant. The savings have been mainly under the head of telegraphic messages, postage, and payments to provincial observers. The amount of the Bengal Provincial grant was calculated on the supposition that the new observatories would be in working order on the 1st April. Hence as the majority of them were not established until the middle of June or beginning of July, there was a considerable saving in the amount of payments to observers, and also under the head of telegraphic messages or weather telegrams. The transmission of observations by telegram and post under the extended system has also, in consequence of the ready co-operation of the various officials and the almost exclusive use of postal cards in place of the meteorological forms such as have hitherto been employed, been less expensive than I anticipated, and I have therefore proposed to Government that a portion of the Bengal Provincial grant, which would otherwise lapse yearly, be utilized to provide for certain additional observatories which are much needed to give additional information, and for a further increase of my office establishment.

There is apparently a large saving under the head "Building and repairs;" but this is, so far as I can ascertain, not real, but due to the fact that the cost of several of the new observatories has not been debited yet against the Meteorological Department by book transfer between it and the Public Works Department.

The figures in the statement give the total expenditure so far as can be at present ascertained by my office.

The statement does not include the cost of instruments supplied to the observatories by the Indian Meteorological Department, nor of the cost of stationery supplied to the Central Office, nor of the cost of printing the meteorological returns given in the Gazette or otherwise, or the forms required in the Meteorological office, by the Bengal Secretariat Press.

JOHN ELIOT, M.A.; F.M.S.,
Meteorological Reporter to the
Government of Bengal.

METEOROLOGICAL OFFICE, BENGAL;
The 29th April 1884.

APPENDIX B.

Extracts from the Administration Report of the Meteorological Reporter to Government, North-Western Provinces and Oudh, for the year 1883-84.

The changes which have taken place during the year 1883-84 have been that the Reporter, Mr. S. A. Hill, took furlough from the 20th May 1883. At first Mr. Hill intended to have been absent one year only, but since he has been at home he has had the period extended by five months, and will not, therefore, rejoin his appointment till the 20th October. During Mr. Hill's absence I (Dr. Murray Thomson) have officiated as Reporter. The only other important change has been the abolition of the observatory at Paori, Garhwal. This observatory originated in the offer of the Missionary stationed there to take observations if instruments were supplied to him. After some time a small monthly allowance was paid to the observer; but, as there was no budget provision for the allowance, Mr. Hill very generously paid it out of his private funds, but it was discontinued when he left India. It was then found impossible to carry on the observatory without an allowance, and it was, therefore, resolved to remove the instruments, which was accordingly done. This is the less to be regretted as the Kumaon district has still two observatories—one at Ranikhet and one at Pithoragarh.

The following table shows the observatories which send records to this office and states how they are maintained. In the Appendix B II will be found a list of the Superintendents and the observers at these observatories:—

How maintained.	Class.			
	I.	II.	III.	
By Meteorological Department.	Allahabad (in abeyance).	Allahabad. Lucknow. Agra. Roorkee.	Chakráta. Ránikhet. Pithoragarh. Bareilly. Gorakhpur. Benares. Sutna. Jhánsi. Ajmere. Sambhar.	
By other Government Departments.				Dehra.[1] Ghazipur.[2] Meerut.[4] Nowgong.[5]
Voluntarily by independent States, &c.	Jeypur.[3]			

[1] Maintained by Survey Department.
[2] Ditto Opium Agency.
[3] Ditto State Darbar.
[4] Maintained by Municipality.
[5] Observer unpaid.

FIRST CLASS OBSERVATORIES.

The only observatory of this kind which is fully equipped is that at Jeypur. The preceding table shows that this is maintained by the Jeypur Darbar.

A special report on the working of this observatory during the past year has been furnished by its acting Superintendent, Surgeon C. W. Owen, C.I.E. Some extracts from this report will be given further on (Appendix B I). As has more than once been stated in these reports, it is intended to have a first class observatory at Allahabad, and the self-recording instruments intended for it have been lying unused in Calcutta for many months. All that is wanted is a suitable building in which to erect them. Sanction had been obtained to the greater part of the cost of this building, and a site had been fixed on, and a piece of suitable ground had been given, and the plans were prepared, when it was found necessary by the Government of the North-Western Provinces to withdraw sanction to the expenditure of the previously allotted money in favour of more urgent public works. This necessity is deeply to be regretted, as already the building of this observatory has been postponed from various causes for now over two years.

Allahabad is still worked as a second class station, and furnishes a very full set of observations. The observer has worked well during the past year, and the personal extra allowance of Rs. 10 per mensem is to be continued to him.

At present two of the instruments are, for want of a better site, exposed on the roof of the building now used as the Muir College, which is nearly a mile from the present main observatory. This is a very inconvenient arrangement, and I have requested sanction for the erection of a small tower, 30 feet high, near the present observatory, on which to place the instruments just mentioned and have them within easy reach.[1]

It was mentioned in last report that an experimental observatory had been set up in the grounds of the new Muir College in order to anticipate the effect on the observations by the removal of the instruments to a more open site. A table giving a comparison of the observations made at this new site with those made at the old was given in the last report, and a continuation of this table is given in this report.[2] As this experimental observatory has now served its purpose, observations at it have been discontinued since the 31st March of this year.

The underground temperature observations made with thermometers placed at half-an-inch, one foot, and three feet below the surface, have been continued during the past year.

* * * * * * *

SECOND CLASS OBSERVATORIES.

Lucknow.—There is very little to add to the remarks made on this observatory in the last report. A glass-case to protect the clock-work of the anemograph has been made. During an unofficial visit made to Lucknow in January last I went over the observatory and found all the instruments in good order; but a cover for the clock-work was much wanted, and I requested that one should be made for it. The observer here is an intelligent man, and has again rendered a good year's work: so he retains for another year the personal extra allowance of Rs. 10 a month.

Agra.—The only remark to be made on the observatory here is that the reading of the instruments is well and punctually done, but there is no improvement on the registers sent in. A good many corrections on errors in the computation have to be made. On account of this want of improvement I did not recommend the restoration of the full personal extra allowance. The observer will, therefore, for another year at least draw the minor allowance only.

Roorkee.—I inspected this observatory in October last and found all the instruments clean and in good order. The large Adie's barometer is still in use. A small portion of the inner surface of the tube has got fouled; several attempts to clear the tube have been made, but without success. Fortunately, the reading of the mercury level can still be made; and with accuracy, if care is taken. If this fouling of the tube increases, there is another compared barometer ready to take the place of the older one, so that there will be no discontinuity of the observations.

The observer here is a hard-working man, and is fairly neat and very punctual in his returns, and his computing work has greatly improved.

* * * * *

THIRD CLASS OBSERVATORIES.

Chakráta.—This station was inspected by me in October last. I found the instruments in good order and well situated, except the rain-gauge, the position of which I had altered so as to secure a freer exposure. At the time of my visit the observer, Salig Ram, stated that he was to be transferred to another Division of the Military Works (he is a draughtsman in the Office of the Executive Engineer of Military Works, and the latter is Superintendent of the observatory), but I am glad to be able to report that no change has been made. As this observer has worked well, his personal allowance of Rs. 5 has been continued for another year.

Meerut.—I visited this station in October last and found that all the instruments had been well cared for. The observer can be quite accurate in his reading of the instruments, but he is not always so. A bad instance of this occurred last December, when he sent in for the daily telegraphic report a series of wrong readings of the barometer: in them the error was found to depend on faulty adjustment of the fiducial point in the cistern of the instrument. When attention was called to this fault more correct readings were immediately rendered.

---

[1] Since the above paragraph was written Government has sanctioned the cost of this tower.

[2] Not reproduced here.—H. F. B.

While visiting Chakráta, Roorkee, and Meerut, I also visited the observatory at Saint Fidelis' School in Mussooree. This station reports directly to the Reporter with the Government of India, and it was at the request of the latter that I made this inspection, for this observatory does not come under the supervision of the local Reporter. I was not at all pleased with the arrangements I saw. The instruments are well exposed, but they looked dirty and not over carefully attended to. A European youth of about 15 or 16 years of age was the observer. It was obvious he was not much impressed with the importance of being either accurate or punctual, although, I dare say, he would not intentionally send in erroneous work. Father MacCarthy, the Superintendent, put in a claim for a monthly allowance. I supported this claim, but with the proviso that, if given, it might be withdrawn at any time if careless work was rendered.

OTHER OBSERVATORIES.

There are no remarks to be made on any other of the observatories. The work in them all, so far as can be judged from the returns sent, has been done with a fair amount of accuracy and punctuality.

* * * * * * * * *

RAINFALL REGISTRATION.

The chief stations in all districts of the North-Western Provinces and Oudh are now supplid with rain-gauges of the Symon's pattern, but the subordinate stations still use the float and rod gauge.

The number of places which send in rain registers is 253. A separate annual report for the calendar year 1883, giving monthly and annual totals, was compiled in this office and published as a supplement to the Government Gazette of 29th March last.

A new edition of Mr. Hill's paper "On the Rainfall of the North-Western Provinces and Oudh" was published last year and was illustrated with a well-executed map.

* * * * * * * * *

INSTRUMENTS.

Full details as to instruments issued to the various observatories are given in Appendix [1] and those broken in Appendix B III. * * * The number of breakages is very small, and is mostly confined to the exposed thermometers—sun and grass radiation. The anemometer entered for Agra as broken was really worn out and was no longer fit for use.

STATEMENT OF EXPENDITURE.

This will be found in Appendix B V. The total expenditure is larger by Rs. 375 than in the previous year. This is accounted for by the entertainment of an additional clerk on Rs. 15 a month and the pay of all the clerks in the Reporter's office was increased by Rs. 5 a month for each clerk. The sanction of Government was obtained to the increase of expenditure for the purposes just mentioned.

OFFICE AND OFFICE WORK.

There is nothing to enter under this head, except that sanction was obtained from Government, as already mentioned, to the employment of an additional clerk on a salary of Rs. 15 a month. The establishment in the Reporter's office, as it now stands, is as follows:—

		Rs.
Chintamony Ghosh, head clerk		92
Kaliprosono Datta, 2nd	„	55
Makhan Lal Mookerji, Tabulator		35
Ram Charan Pande,	Ditto	25
Sasi Bhusan Banerji,	Ditto	25
Ashutosh Bose,	Ditto	15
One peon		6
One daftri		7
		260

No special work has been attempted this year, but the ordinary work has been well done.

---

[1] This is incorporated in the general return in Appendix K.

APPENDIX B I.

Extracts from Report on Observatory at Jeypur, by SURGEON C. W. OWEN, C.I.E.

"METEOROLOGICAL OBSERVATORY, JEYPUR.

Two new instruments have been added during the year, *viz.*, the Nephescope and the Sunshine Recorder.

The compound walls have been thoroughly repaired, the railings painted, the meteorograph tower re-coloured, new steps provided: in fact, the whole observatory has been thoroughly done up.

A great improvement has been effected in the meteorograph room by removing the battery to a separate room, where there is a more equable temperature.

Sheds have been built for the observers and new thatch has been placed on the guard and thermometer sheds.

All these repairs and improvements have been carried out without any extra expense to the Darbar.

List of Staff—

Durga Parshad	1st observer.
Nathu Narain	2nd ditto.
Hurbux	3rd ditto.
Hardeo	Peon.

Mr. Callaghan, the Electrician, has been of the greatest service during the year, and my best thanks are due to him for his ready assistance at all times. Daily weather telegrams have been despatched throughout the year to Simla and Calcutta.

Osler's anemograph.—This instrument, which forms a continuous register on metallic paper wrapped round the drum of the instrument, shows the direction, velocity, and force of the wind, and has been working nearly accurately throughout the whole year. The rainfall registered by this instrument during the year was 19·47 and the prevailing wind was north-west.

Nephescope.—This instrument is a new invention and consists simply of a glass mirror with the cardinal points marked on it and fitted with an iron pointer, so that the direction of movement of the upper-strata air can be noted by watching in which direction the clouds move from the fixed pointer.

This glass is placed on a marble column, on which the true magnetic North is marked. When exposed it distinctly reflects the whole sky; so that one can easily ascertain in what direction a particular cloud moves without the eyes being in the least dazzled by the intense light of the sun.

Sunshine recorder.—This instrument, which has lately been received, consists of a perfect globe of crystal, set in a stand and supported between two concave-surfaced screws, and is provided with a moveable arc, which requires adjustment according to the season of the year.

When exposed, a card of coloured paper with the gradations of hours marked on it from 6 A.M. to 6 P.M. is placed in the segment of the circle underneath the ball, and the rays of the sun are focussed on the middle of the scale, which chars the paper as long as the sun shines.

This charred line shows the hours during which the sun shone. It has been in use from the 1st of February 1884.

Meteorograph.—The working of this instrument during the year was on the whole satisfactory.

The instrument stopped on a few occasions, caused, firstly, by the warping of the wood fixed to the back of the cabinet, to which the different instruments are attached; secondly, the failure of battery power owing to imperfect porous pots procured in India and from England.

These imperfections have since been removed, first, by brass connections screwed to the detached pieces of wood; and secondly, by replacing the Daniel by a Menotti battery. This change was made on 1st November 1883, and it has worked very well since. It is presumed that this battery will last for another twelve months. The anemometer is the only portion of the instrument that gives trouble; the mechanism is so delicate that it frequently gets out of order, owing to the breakage of the delicate contact springs. These have been several times replaced and as often broken. We are now working it with light steel springs as a temporary arrangement until such a time as those indented for from Belgium arrive. Great difficulty was experienced in printing from the etched plates, owing to the want of a suitable press, and also owing to the etching not being sufficiently deep. A lithographic press is now in use adjusted to the pressure required, and the printing from this is as good as can be expected. We have begun to take very good impressions from 1st October 1883.

All the instruments that make up the meteorograph, except the anemometer, are in good working order, and the rainfall as registered by this instrument during the year 1883 was 20·85 inches.

APPENDIX B II.

Names of the Superintendents and of the Observers at the Meteorological Observatories in North-Western Provinces and Oudh during the year 1883-84.

Observatory.	Class.	Officer in charge.	Date.		Observers.	Date.	
			From	To		From	To
Allahabad	Second	S. A. Hill, Esq. Dr. Murray Thomson	1st April, 1883 16th May, 1883	15th May, 1883 31st March, 1884	Kedar Nath Chaterji, Observer Jadu Nath Chaterji, Observer at the new Observatory. Bhola Nath Chaterji Sasi Bhusan Banerji, Assistant Observer	1st April, 1883 Ditto 24th August, 1883 1st April, 1883	31st March, 1884. 23rd August, 1883. 31st March, 1884. Ditto.
Agra	Ditto	,, A. H. Hilson	1st April, 1883	Ditto	Mir Altaf Ali, Observer Abdul Majid Khan, Assistant Observer	Ditto Ditto	Ditto. Ditto.
Lucknow	Ditto	,, J. C. Whishaw ,, J. Cameron	Ditto 6th February, 1884	5th February, 1884 31st March, 1884	Chotey Lal, Observer Durga Parshad, Assistant Observer	Ditto Ditto	Ditto. Ditto.
Roorkeo	Ditto	,, Murray Thomson Lieut. G. Onslow, R.E.	1st April, 1883 16th May, 1883	15th May, 1883 31st March, 1884	Cheranji Lal, Observer Tulsee Ram, Assistant Observer Jug Mohan Lal, Assistant Observer	Ditto Ditto 15th October, 1883	Ditto. 14th October, 1883. 31st March, 1884.
Jeypur	First	Surgeon-Major Hendley Surgeon C. W. Owen, C.I.E.	1st April, 1883 23rd April, 1883	22nd April, 1883 31st March, 1884	Durga Parshad, Observer Nathu Narain, Observer Hurbax, Observer	1st April, 1883 Ditto 1st July, 1883	Ditto. Ditto. Ditto.
Chakrata	Third	Captain A. C. Ward	1st April, 1883	Ditto	Saligram	1st April, 1883	Ditto.
Paori	Ditto	Revd. J. T. McMahon	Ditto	30th Nov., 1883	Revd. F. W. Greenold	Ditto	30th Nov., 1883.
Pithoragarh	Ditto	,, Dr. R. Grey, and Revd. Buck	Ditto	31st Marcb, 1884	Sher Singh	Ditto	31st March, 1884.
Ranikhet	Ditto	No Superintendent	......	......	Jewa Nund	Ditto	Ditto.
Dehra	Ditto	Deputy Supdt., Survey of India	1st April, 1883	31st March, 1884	The Head Computors	Ditto	Ditto.
Meerut	Ditto	Dr. W. Moir	Ditto	Ditto	Harsaran Das	Ditto	Ditto.
Bareilly	Ditto	E. A. Phillips	Ditto	Ditto	Jwala Parshad	Ditto	Ditto.
Gorakhpur	Ditto	Dr. C. Prentis	Ditto	Ditto	Nizam-ud-din	Ditto	Ditto.
Benares	Ditto	Principal, Benares College	Ditto	Ditto	Deokinandan Patak	Ditto	Ditto.
Ghazipur	Ditto	Dr. P. A. Weir	Ditto	Ditto	Babu Kunjan	Ditto	Ditto.
Sutna	Ditto	Agency Surgeon	Ditto	Ditto	Harnath	Ditto	Ditto.
Nowgong	Ditto	A. P. Mitchel, Esq.	Ditto	Ditto	......	......	......
Sambhar	Ditto	W. Poneter, Esq.	Ditto	Ditto	J. Romare	1st April, 1883	31st March, 1884.
Jhansi	Ditto	Surgeon-Major Eades, Dr. Simmonds	Ditto	Ditto	Kalka Das	Ditto	Ditto.
Ajmere	Ditto	Dr. J. H. Newman	Ditto	Ditto	Ram Parshad	Ditto	Ditto.

APPENDIX B III.

Return of Instruments broken or otherwise injured at the Observatories in N.-W. Provinces and Oudh during the year 1883-84.

STATION.	Solar thermometer.	Maximum thermometer.	Grass thermometer.	Anemometer.	Solar thermometer stand.	Earth thermometer.	Wet bulb of hygrometer.	REMARKS.
Chakráta	1	...	...	...	...	...	...	
Ránikhet	...	1	...	...	...	...	...	
Agra	...	...	1	1	...	...	...	
Lucknow	1	...	...	...	1	...	...	
Allahabad new observatory	...	...	...	...	...	2	...	
Benares	...	...	1	...	...	...	...	
Sámbhar	1	...	...	...	...	...	2	
Ajmere	...	...	1	...	...	...	...	
Gázipur	...	...	1	...	...	...	...	

APPENDIX B IV.

Results of Underground Temperature Observations at Allahabad.

MONTH.	SURFACE.				ONE FOOT DEEP.				THREE FEET DEEP.				MEAN TEMPERATURE.			
	4 h.	10 h.	16 h.	22 h.	4 h.	10 h.	16 h.	22 h.	4 h.	10 h.	16 h.	22 h.	Air in shade.	Ground surface.	One foot deep.	Three feet deep.
April 1883 .	77·0	101·8	102·9	84·3	86·4	85·3	86·3	87·7	81·9	81·9	82·1	82·1	88·9	91·5	86·4	82·0
May ,, .	83·2	106·9	106·5	89·8	92·8	91·8	92·6	93·8	88·0	88·0	88·1	88·0	94·1	96·6	92·8	88·0
June ,, .	85·5	98·8	98·4	89·1	91·7	90·9	91·8	92·4	89·4	89·2	89·4	89·4	91·3	93·0	91·7	89·4
July ,, .	83·3	88·3	90·5	85·5	87·4	86·8	87·0	87·6	87·4	87·3	87·4	87·3	84·8	86·9	87·2	87·4
August ,, .	83·6	90·3	93·6	86·3	88·1	87·7	88·0	88·7	87·3	87·3	87·4	87·4	85·9	88·4	88·1	87·4
September ,, .	81·5	90·1	91·3	87·2	86·9	86·4	86·8	87·4	87·1	87·0	87·1	87·1	83·1	87·5	86·9	87·1
October ,, .	72·7	87·5	90·2	76·7	82·0	81·3	82·1	82·7	84·2	84·2	84·3	84·2	77·4	81·8	82·0	84·2
November ,, .	60·7	75·4	82·0	65·8	73·0	72·5	73·2	73·8	78·0	77·9	78·2	78·0	66·0	71·0	73·1	78·0
December ,, .	52·2	64·2	74·5	57·6	64·6	64·1	54·7	65·7	70·6	70·6	71·0	70·9	57·9	62·1	64·8	70·8
January 1884 .	55·0	65·8	77·3	60·7	65·7	65·0	65·5	66·8	69·0	69·0	69·4	69·3	61·0	64·7	65·8	69·2
February ,, .	58·3	70·7	82·2	65·2	69·0	68·2	68·9	70·3	70·8	70·8	71·1	71·1	65·0	69·1	69·1	71·0
March ,, .	71·0	90·9	97·7	78·1	80·1	79·3	80·0	81·6	77·8	77·9	78·1	78·1	80·1	84·4	80·2	78·0
Year .	72·0	85·9	90·6	77·2	80·6	79·9	80·6	81·5	81·0	80·9	81·1	81·1	77·9	81·4	80·7	81·0

APPENDIX B V.

Statement showing the expenditure of the North-Western Provinces Meteorological Department for the year 1882-83 (not including stationery, printing, or cost of instruments).

STATION.	IMPERIAL SERVICES.			
	Establishment.	Contingencies.	Reporter's travelling allowances.	Total.
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Meteorological Reporter	3,000 0 0	...	307 12 0	3,307 12 0
Ditto Office	3,105 14 0	†1,256 6 6	...	4,362 4 6
Allahabad Observatory	720 0 0	...	...	720 0 0
Ditto New observatory	*180 0 0	...	...	180 0 0
Agra Observatory	900 0 0	25 0 0	...	925 0 0
Roorkee ditto	900 0 0	14 15 0	...	914 15 0
Lucknow ditto	1,020 0 0	23 4 6	...	1,043 4 6
Chakráta ditto	240 0 0	...	...	240 0 0
Ránikhet ditto	300 0 0	...	...	300 0 0
Pithoragarh ditto	180 0 0	...	...	180 0 0
Bareilly ditto	180 0 0	...	...	180 0 0
Gorakhpur ditto	180 0 0	‡4 8 0	...	184 8 0
Benares ditto	240 0 0	...	...	240 0 0
Jhansi ditto	180 0 0	...	...	180 0 0
TOTAL	11,325 14 0	1,324 2 0	307 12 0	12,957 12 0

* Temporary establishment for taking meteorological observations at the new observatory.

† Including office rent, charges for repairs to the observatories, and general contingencies of the Meteorological office and Allahabad observatory.

‡ Excluding charges for weather telegrams.

APPENDIX C.

Administration Report of the Meteorological Reporter to the Punjab Government for the year 1883-84.

The work of the Punjab Meteorological department in the past year has been carried on as usual. No change has been made in any of the observatories, which remain as follow:—

Lahore, Ludhiana, Simla, Delhi, Sirsa, Dera Ismail Khan, Multan, Sialkot, Rawalpindi, Murree, Peshawar, and *Leh* (*Ladakh*).

2. All of them, except Lahore and Leh, work as 3rd class; Leh and Lahore serve as 2nd class observatories. The position of the Lahore Observatory is faulty, but a better site is in contemplation by the Punjab Government, and the observatory will shortly be raised to a first class one.

3. As a second class station, Lahore registers 5 sets of daily observations, in addition to those registered here hourly, on 4 days in a month, *i.e.*, on 7th, 14th, 21st, and 28th of every month.

The observatory is under my daily supervision, in charge of Babu Jaspat Rai, the chief observer, and the condition of the observatory and good state of preservation of the instruments are due to the care of this observer.

4. The staff of the observatory, as in previous years, consists of an observer and assistant observer on a salary of Rs. 30 a month.

In addition to the routine work of the observatory, the observer in charge furnishes daily information of weather and climate to the *Civil and Military Gazette.*

INSPECTION.

5. During the year under report the observatories at Ludhiana, Simla, Delhi, and Sialkot were inspected and found to be in excellent order. The general character of the work of the observatories is very satisfactory.

I have little or no complaint against any of the observers. It was my intention to inspect all the observatories in the Punjab during the rains in the month of August, which is one of the vacation months at the Medical College; but last year the rain failed altogether in August and it was too hot to travel about in the plains; while in September I could not leave Lahore. The work of inspection is so important that I should like to make my chief observer, who is a reliable man, travel about inspecting the observatories at least twice every year.

6. All the observers selected for meritorious allowance during the year 1883-84 retained their allowance for the ensuing year. One of the observers, who was deprived of his meritorious allowance last year on account of laxity in his work, has been restored to the list of merit again, and will get Rs. 5, the increased allowance, in the ensuing year.

7. The office work is steadily increasing year by year, and on this account the engagement of a 3rd clerk was necessary during 1883. But, as we have taken in hand the computation of vapor tension and the making of duplicate copies, &c., which was done in the Head Office, Calcutta, heretofore, the addition of a new clerk has not given much relief to the existing pressure. The work is still in excess, and is too much for a small staff like ours.

8. The establishment of the Punjab Meteorological Office stands as follows :—

	Rs.	a.	p.
1 Head Clerk	50	0	0
1 Second Clerk	15	0	0
1 Third Clerk	15	0	0

9. During the year the Meteorological Office was removed from the Medical College, where it had been located since that building was opened, to new premises in the site of the old Dâk Bungalow. This arrangement is extremely inconvenient for the observers, who are also the office clerks, as the office is now nearly half a mile away from the observatory. I believe and hope that it is intended to increase the office establishment and raise the observatory to first class rank, and at the same time the present objectionable site of the observatory is to be abandoned and a new one is to be secured. In the new building the office will be attached to the observatory, and the work of both will be much facilitated.

10. The usual statements are herewith appended.

E. LAWRIE, M.B.,

Meteorological Repoter for Punjab Government.

LAHORE;

The 11th June 1884.

APPENDIX C II.

Table showing the Names of the Superintendents and Observers at the Meteorological Observatories in the Province of Punjab during the year 1883-84.

No.	Observatories.	Class.	Names of Superintendents.	Period.		Name of Observer.	Period.		Allowance.	
				From	To		From	To	Monthly allowance.	Meritorious allowance.
1	LAHORE	II	Ed. Lawrie, M.B., Meteorological Reporter, Punjab	Throughout		Jasput Rai, Chief Observer Dewan Chund, Assistant	Throughout		20 10	5 5
2	PESHAWAR	III	Surgeon W. Coates, M.D. " M. O'Dinyer, M.B. " T. E. L. Bate	1st April 1813 18th April " 19th Feb. 1884	17th April 1883 18th Feb. 1884 31st Mar. "	Kashi Ram, Observer	Throughout		15	5
3	MURREE	III	Revd. G. C. Peake	Throughout		Mr. Cruickshank	Throughout		15	5
4	SIALKOT	III	Dr. Thomas S. Veele " G. J. Shoud	1st April 1883 15th Oct. "	14th Oct. 1883 31st Mar. 1884	Futteh Singh, Assistant Surgeon Purma Nand " Futteh Singh " Sada Nand "	1st April 1883 6th July " 14th Oct. " 14th Dec. "	5th July 1883 13th Oct. " 13th Dec. " 31st Mar. 1884	15	
5	MULTAN	III	Surgeon-Major J. Bennett, M.D. " P. R. Mulroney, M.D.	1st Mar. 1883 28th Mar. 1884	27th Mar. 1884 31st Mar. "	Mr. Wahid Alli	Throughout		15	
6	DERA ISMAIL KHAN	III	Surgeon P. de. H. Haig M. C. Cartin Surgeon-Major A. P. Holmes	1st April 1883 24th Oct. " 10th Dec. "	23rd Oct. 1883 9th Dec. " 31st Mar 1884	Nur Buksh Moshin Alli Nur Buksh	1st April 1883 22nd May " 19th June "	21st May 1883 18th June " 31st Mar. 1884	15	
7	SIRSA	III	R, Crossley, Civil Surgeon	Throughout		Shamsunder Lall Fazal Rahman	1st April " 25th April "	24th April 1883 31st Mar. 1884	15	5
8	DELHI	III	Surgeon-Major G. C. Ross, Civil Surgeon.	Throughout the year		Asst.-Surgeon Ramkishen Pandit Bansi Dhur	1st April " 24th July "	23rd July 1883 31st Mar. 1884	15	
9	SIMLA	III	Quartermaster General in India	Throughout		Sergeant J. J. Koings	28th May "	31st Mar. "	15	
10	LUDHIANA	III	Dr. Rouse, Civil Surgeon	Throughout		Asst. Surgeon Bhagwan Das Asst.-Surgeon Rallia Singh Asst.-Surgeon Bhagwan Das Asst.-Surgeon Sada Nand Asst.-Surgeon Bhagwan Das	1st April " 11th May " 18th July " 1st Aug. " 28th Oct. "	10th May 1883 17th July " 28th July " 27th Oct. " 31st Mar. 1884	15	
11	RAWALPINDI	III	Dr. G. Massy " T. R. Mulrony " G. Massy	1st April 1883 15th April " 15th June "	14th April 1883 14th June " 30th Mar. 1884	Asst.-Surgeon Bhagwan Das	Throughout		15	

E. LAWRIE, M.B.,
Meteorological Reporter for the Govt. of Punjab.

APPENDIX D.

Extracts from the Administration Report of the Sanitary Commissioner, Central Provinces.

1. I only took charge in December 1883, and so inspected only the Seoni Observatory. I found it in good order.

2. The observatories remained the same as in 1882.

3. *Nagpur.*—Observer's conduct good.

4. *Jubbulpore.*—The Superintendent reports more favourably of the observer, but still is not sufficiently satisfied to recommend him for enhanced pay.

5. *Pachmarhi.*—The Superintendent was transferred to another station, so there is not any report on the observer's conduct.

6. *Chanda.*—The observer is well reported of. The Superintendent was changed thrice during the year.

7. *Saugor.*—The observer was most unfavourably reported of, and has, since the close of the year, absconded. The Superintendent was thrice changed.

8. *Seoni.*—The observer is, as on former occasions, well spoken of, and the Superintendent would be glad to see his pay increased.

A series of readings of a maximum and minimum thermometer, placed on an island in the middle of a large tank, were made during the whole year, for comparison with those taken in the observatory. The Superintendent summarises the observation thus:—

"It is thus shown that the minimum temperature was lower during the hot weather, owing to "evaporation: and higher in the other 3 quarters, owing to the water retaining the heat longer than "the land; these temperatures represent the condition at night.

"The day or maximum temperature was higher on the island in the cold months and lower in the hot months for similar reasons—retention of heat when there was little evaporation and absorption of heat from the air during evaporation.

"The island is about 800 yards from the observatory."

9. *Hoshangabad.*—There is nothing to note regarding this station, except that the conduct of the observer was good.

10. *Khandwa.*—A new barometer room was finished and the barometer moved into it on the 1st July. The meteorological shed was re-roofed and wire fencing placed round it. The observer is well reported of. The Superintendent was once changed during the year.

11. *Raipur.*—The barometer was moved during the year and the Superintendent reports its present position as "all that can be desired." The observer's conduct is well reported of.

12. *Sambalpur.*—A second shed was erected on the old parade ground, near the bomb-proof magazine, which is now the barometer-room; the anemometer and rain-gauge were also moved up to this site, which is open and free from trees and buildings. The old shed by the jail was repaired. The old instruments remain in the old shed and comparative observations have been taken since the 16th October last. In the new shed the following instruments were brought into use:—

Hygrometer, dry bulb; hygrometer, wet bulb; dry maximum thermometer; dry minimum thermometer; wet minimum thermometer; grass radiation thermometer; sun radiation thermometer; rain-gauge; and a barometer received on the 11th July was brought into use in the new room on the 16th October.

The Observer, Shamsoondur Dass, is well reported of. A second observer, Hospital Assistant Syed Mahomad Hydar Hussain Hydar, of the Jail Hospital, was entertained on the 16th October, and is said to observe regularly and correctly.

13. *Sironcha.*—The observer is well reported of. The Superintendent was once changed.

14. The usual statements are annexed.

JAMES H. LOCH, M.D.,
Offg. Deputy Surgeon-General and
Sanitary Commr., Central Provinces.

NAGPUR,
The 3rd May 1884.

APPENDIX D II.

Names of the Superintendents and Observers at the Meteorological Observatories in the Central Provinces during the year 1883-84.

Observatory.	Class.	Officer in Charge.	Date. From	Date. To	Observers.	Date. From	Date. To	Remarks.
Nagpur	Second	Surgeon-Major R. T. Wright, M.D.	1st April 1883	31st Mar. 1884	T. V. Allagheri Swamy	1st April 1883	31st Mar. 1884	
					Assistant Observer.			
					T. Soobiah	1st April ,,	31st Mar. ,,	
Jubbulpore	Ditto	Surgeon-Major W. R. Rice, M.D.	1st April ,,	31st Mar. ,,	Pandit Saduram Dubay	1st April ,,	31st Mai. ,,	
					Assistant Observer.			
					Hospital Assistant Kunji Behari Lal	1st April ,,	31st Mar. ,,	
Pachmarhi	Ditto	L. Gordon, Esq.	1st April ,,	31st Jan. ,,	Madho Rao	1st April ,,	31st Jan. ,,	
		The appointment of Superintendent was vacant	1st Feb. 1884	31st Mar. ,,	Kesho Rao	1st Feb. 1884	31st Mar. ,,	
Saugor	Third	Surgeon-Major E. O. Tandy	1st April 1883	26th June 1883	*Assistant Observers.*			
		Surgeon-Major J. W. Strong	27th June ,,	7th Dec. ,,	Kesho Rao	1st April 1883	31st Jan. ,,	
		Surgeon-Major E. O. Tandy	8th Dec. ,,	31st Mar. 1884	Luxmun Rao	1st Feb. 1884	31st Mar. ,,	
					Yado Rao	1st April 1883	6th Mar. ,,	
					The appointment of observer was vacant	7th Mar. 1884	12th Mar. ,,	
					Deevayal	13th Mar. ,,	31st Mar. ,,	
Hoshangabad	Ditto	Surgeon S. H. Browne, M.D.	1st April ,,	31st Mar. ,,	Jadunath Bose	1st April 1883	31st Mar. ,,	
Khandwa	Ditto	Surgeon-Major P. Cullen, M.D.	1st April ,,	16th July 1883	Bihari Lal Parasar	1st April ,,	31st Mar. ,,	
		Surgeon-Major G. R. Dafthary, M.D.	17th July ,,	18th Oct. ,,				
		Surgeon-Major P. Cullen M.D.	19th Oct. ,,	31st Mar. 1884				
Seoni	Ditto	Surgeon-Major J. B. Gaffney	1st April ,,	31st Mnr. ,,	Punchum	1st April ,,	31st Mar. ,,	
Chanda	Ditto	Surgeon H. Armstrong	1st April ,,	14th April 1883	Seetaram	1st April ,,	31st Mar. ,,	
		Appointment of Superintendent was vacant	13th April ,,	30th April ,,				
		Assistant Surgeon Haran Chunder Dutt	1st May ,,	31st Aug. ,,				
		Assistant Surgeon Shib Chunder Bhattacharji	1st Sept. ,,	31st Mar. 1884				
Sironcha	Ditto	Assistant Surgeon Haran Chunder Dutt	1st April ,,	16th April 1883	Hospital Assistant Muthu Krishna Naidu	1st April ,,	31st Mar. ,,	
		Tehsildar Horahar Govind	17th April ,,	31st Mar. 1884				
Raipur	Ditto	Brigade-Surgeon D. W. Trimnell	1st April ,,	6th April 1883	Krishna Rao	1st April ,,	31st Mar. ,,	
		Surgeon-Major J. F. Barter	7th April ,,	6th July ,,				
		Brigade-Surgeon D. W. Trimnell	7th July ,,	31st Mar. 1884				
Sambalpur	Ditto	Honorary Surgeon-Major J. E. Harrison	1st April ,,	31st Mar. ,,	Babu Sham Sunder Dass	1st April ,,	31st Mar. ,,	
					Additional Observer.			
					Hospital Assistant Syed Mahamad Hyder Hussain Hydari	16th Oct. ,,	31st Mar. ,,	

APPENDIX E.

List showing the Names of the Superintendents and Observers at the Meteorological Observatories reporting immediately to the Office of the Meteorological Reporter to the Government of India during the year 1883-84.

Observatories.	Class.	Names of Superintendents.	Period.		Names of Observers.	Period.	
			From	To		From	To
ADEN	Third	Captain C. W. H. Sealy Major F. M. Hunter Captain C. W. H. Sealy Captain J. S. King	1st April 1883 30th Nov. ,, 1st Feb. 1884 21st Feb. ,,	29th Nov. 1883 31st Jan. 1884 20th Feb. ,, 31st Mar. ,,	D. C. Cotinho, Observer A. S. Vas, ,, Shaik Ebrahim, ,, Walter Abrabam, ,, Shaik Ebrahim, Asst. Observer A. S. Vas, ,, ,, B. C. Cordeiro, ,, ,,	1st April 1883 30th Aug. ,, 19th Sept. ,, 16th Mar. 1884 1st April 1883 19th Sept. ,, 1st Jan. 1884	29th Aug. 1883. 18th Sept. ,, 15th Mar. 1884. 31st Mar. ,, 18th Sept. 1883. 31st Dec. ,, 31st Mar. 1884.
BUSHIRE	Ditto	Lieutenant-Colonel E. C. Ross, C.S.I.	1st April 1883	31st Mar. ,,	Mr. Azivedo	1st April 1883	31st Mar. ,,
QUETTA	Ditto	J. C. Fullerton, M.B.	1st April ,,	31st Mar. ,,	A. Samuel Pillay	1st April ,,	31st Mar. ,,
PACHBUDRA	Ditto	Mr. G. A. Bradford	1st April ,,	31st Mar. ,,	Mr. P. Holder Khudabux Rash Behari Ghosh	1st April ,, 22nd July ,, 13th Feb. 1884	21st July 1883. 12th Feb. 1884. 31st Mar. ,,
MUSSOOREE	Ditto	Revd. Father Lawrence ,, ,, Benedict	1st April ,, 1st Feb. ,,	31st Jan. ,, 31st Mar. ,,	J. Flynn J. Archibald	1st April 1883 16th Jan. 1884	15th Jan. ,, 31st Mar. ,,
KATMANDU	Ditto	....	......	......	Mohamad Hassain Pashupat Sharan Sinha Mohamad Hassain Pashupat Sharan Sinha	1st April 1883 14th Aug. ,, 21st Oct. ,, 29th Dec. ,,	13th Aug. 1883. 20th Oct. ,, 28th Dec. ,, 31st Mar. 1884.
MONGPOO	Fourth	....	......	......	George A. Gammie	1st April ,,	31st Mar. ,,
MAKHLA	Ditto	J. Balantine, Esq. A. T. Drysdale, Esq. J. Ballantine, Esq.	1st April 1883 28th Aug. ,, 28th Nov. ,,	27th Aug. 1883 27th Nov. ,, 31st Mar. 1884	Kuarsing Narain Yadeo Kuarsing Papannah	1st April ,, 1st Sept. ,, 23rd Sept. ,, 20th Jan. 1884	31st Aug. 1883. 18th Sept. ,, 19th Jan. 1884. 31st Mar. ,,
DIAMOND ISLAND	Third	....	......	......	F. W. Marsh	1st April 1883	31st Mar. ,,
PORT BLAIR	Ditto	Surgeon-Major J. Reid, M.B.	1st April 1883	31st Mar. 1884	J. T. Peters	1st April ,,	31st Mar. ,,
NANCOWRY	Ditto	....	......	......	Shaik Abdood Wahed Shaik Madar Roop Sing Rana	1st April ,, 13th July ,, 25th Feb. 1884	12th July 1883. 24th Feb. 1884. 31st Mar. ,,
KAILANG	Ditto	Revd. A. W. Heyde	1st April 1883	31st Mar. 1884	Tsang Rinchen	1st April 1883	31st Mar. ,,

APPENDIX F.

Extracts from the Report on the Administration of the Meteorological Department in Western India during the year 1883-84.

During the past official year observations have been taken in Western India at 4 second class, 18 third class and 1 storm-warning station. No changes have been made in the nature of the observations; but it has been decided to institute a change in some of the observerships that will probably prove an important one. The same inconvenience which in last year's report it was stated had led to the substitution of civilian, in place of military, observers at the second class stations, has been felt in an equal degree in the case of those third class observatories at which military medical subordinates are observers. It has been determined, therefore, that, wherever practicable, these observers shall be replaced by independent men with whom the meteorological shall be the primary work.

OBSERVATORIES.

The number of observatories, as shown by the list given in Appendix F II, remains the same as in last year. Sanction of the Government of India to the establishment of a voluntary observatory at Baroda was received through the Government of Bombay in September 1883, and accordingly instruments were forwarded to Baroda in November 1883. Mr. Joglekar, the headmaster of the Sirdar High School, who volunteered to establish the observatory, succeeded in getting an anemometer tower built over the porch of the school, and had chosen a site for the thermometer shed, when the school building was required for other purposes. The school had to be removed into temporary quarters, and the anemometer tower had to be pulled down. Mr. Joglekar hopes before long to be able to make other and more permanent arrangements.

For reasons given below under the heading of Inspection of observatories, the project for the establishment of an observatory at the new site at Sholapur has now been definitely abandoned, and after some difficulty arrangements have been made for the continuance of the observatory at the old site

On the 10th of October last, a letter was received from the Surgeon General with the Government of Bombay, stating that the Agency at Zanzibar was on the 1st of September transferred from the Government of Bombay to the English Foreign Office, and requesting that early arrangements might be made for relieving the Hospital Assistant there of his meteorological duties, as he was to be removed from Zanzibar immediately. This was the first intimation the Meteorological Office had of any intended changes at Zanzibar; had earlier information been received earlier arrangements might have been made for the continuance of the observatory there. As it was, the Surgeon General was pleased to agree to, and the Government of Bombay to sanction, the temporary retention as observer of the Hospital Assistant Abdur Rahman until the English Foreign Office could be moved in the matter. Up to the present date nothing has been communicated as to the intentions of the Foreign Office. Surgeon M. L. Bartholomeux, who had been the Agency Surgeon at Zanzibar, gave me, on his return to Bombay, a verbal description of the observatory there. This description agreed in all essential details with that given by Dr. Peters in his paper published in the Royal Meteorological Society's Journal for October 1883; therefore it is not necessary to reproduce it here.

INSPECTION OF OBSERVATORIES.

In October and December 1883; and in March and April 1884, I visited seventeen stations, namely Bhuj, Karachi, Hyderabad (Sind), Jacobabad, Poona, Sholapur, Ratnagiri, Karwar, Calicut, Belgaum, Surat, Baroda, Deesa, Mount Abu, Neemuch, Indore, and Malegaon. Sholapur was visited twice; and with the concurrence of Miss Pogson, Meteorological Reporter to the Government of

Madras, I called, on the way to Calicut, to see the observatory at Mangalore, which is one of the stations forwarding daily weather telegrams to the Bombay Office.

* * * * * * *

SECOND CLASS OBSERVATORIES.

(*1*) *Karachi.*—The instruments here were in good condition and call for no special remark. A new site for the observatory had been chosen near to the anemometer tower; the position was better than the present one. Estimates amounting to Rs. 1,333 have been prepared for the buildings, &c., but, as it has not yet been decided to extend the hospital buildings, I have thought it advisable for the present to allow the matter to remain in abeyance.

(*2*) *Deesa.*—The instruments here were all in good order, except that the recording apparatus of the anemograph required cleaning, and the arrangement for disconnecting the clock and the cylinder were out of order. These matters I attended to. The trap door and the ladder of the anemograph tower were awkwardly constructed, and it was exceedingly difficult and even dangerous to use them. They are now about to be altered. The upper parts of the dry and wet bulb thermometers were screened by the frame-work of the cage door; so that, in order to read the higher degrees it was necessary to open the door. The observer pointed out that immediately after doing so the temperature within the cage went up about ·3 degree. I recommended him always to open the door before reading the thermometers.

The observer had great difficulty in getting an assistant. Deesa is nothing but a military camp, and is very backward in point of education.

(*3*) *Poona.*—The instruments here were in order, except that the grass thermometer pad had no stuffing. The observer had taken observations by Presidency local time instead of Poona local time; there is a difference of about 5 minutes. The Casella's anemograph had worked since last year with as satisfactory results as can be obtained from this class of instrument.

(*4*) *Belgaum.*—Everything on the whole was satisfactory at this observatory. The mercury in the barometer moved sluggishly, but the observer stated that he was in the habit of tapping it before reading. The observer, Ram Chandra Datta, had been trained by his predecessor; I examined him thoroughly, and found that he had taken pains to prepare himself for the examination. I instructed him in those matters in which he was deficient; cloud observation was his weak point, as indeed it is with many observers. I examined the assistant observer also.

Estimates for observatory buildings to be situated near the anemograph tower have been prepared amounting to Rs. 2,764; they have not yet been forwarded to Government for sanction.

THIRD CLASS OBSERVATORIES.

(*5*) *Jacobabad.*—The anemometer and the barometer were in good order. The graduation marks of the thermometers required re-blackening. The grass thermometer had been exposed under the stand of the sun thermometer by Narayen Mane, who had not understood that the sun thermometer stand, which is a moveable one, should have been taken away every night. The raingauge was placed on some bricks, and was in consequence about 3 inches too high. I had it properly fixed in the ground. Narayen Mane had been very ill for some time and quite unable to give proper attention to work of any kind. He was, at my suggestion, replaced in September by Bavaji Rawoot, whose work has given satisfaction.

(*6*) *Hyderabad* (*Sind*).—The instruments at the military hospital were all in good order; and the observer, V. E. Nazareth, who had trained himself in meteorological work by means of the instruction book, showed himself both careful and intelligent.

The same cannot be said for the observer who has charge of the anemometer at the jail. His work is so unsatisfactory in every way that his relief from meteorological duties only awaits the making of other arrangements for continuing the observations.

(*7*) *Bhuj.*—The surface of mercury in the cistern had been coated with a thin layer of rust, and three small particles of dirt had formed on the knife edge. The observer adjusted the mercury until it just touched these three particles; I approved of this method of adjustment, but the effect of it was, of course, to lower the readings, the additional correction required was +·016. The barometer should be locked in a case or screen fixed to the wall; some of the hospital inmates came to finger it even in my presence. The thermometer shed was a little larger than the standard pattern, and the ventilating opening was too large. The thermometer graduation marks required re-blackening. The raingauge had, shortly before my arrival, been tarred all over, including the rim, so that the size of the rim was altered; but this I instructed should be cleaned off at once, and, as no rain had fallen in the meantime, the matter was of no consequence. The instruments in all other respects were in order. The anemometer post however was difficult to ascend; and in carrying the instrument up and down for cleaning, damage was likely to be done to the cups.

(*8*) *Surat.*—The instruments at the camp were found in order. Owing to the destructiveness of jackals, no grass thermometer has been supplied to this station since June 1883. An arrangement had been made by the observer for the protection of the grass thermometer, but it would have interfered with free radiation, and was therefore unsuitable. The wind direction observations of the observer, Dhunjibhai Motabhai had evidently been very roughly taken; and his punctuality was considered doubtful. He has since been ordered away to Quetta.

The observer who had charge of the anemometer at the castle was a new man, who had been instructed by his predecessor. He was intelligent, and easily understood what I taught him. The anemometer was out of order, the pointer being loose, and the spindle bearing the cups having become broken at the junction of the brass with the steel. I put the instrument in order and also instructed the observer in cleaning it.

Surgeon-Major Robb, M.D., F. R. Met. Soc. the Civil Surgeon, who, in accordance with his own wish, had charge of both the observatories, took great interest in the work, and, besides cordially assisting in the superintendence of the observatories, has forwarded to the meteorological office some special observations of his own.

(*9*) *Mount Abu.*—I found that, as previously surmised, the barometer No. 48-1868 by Adie had air in it; it was packed up and returned to Bombay. The old barometer No. 710-1868 was all right, except that the cistern was dirty inside. I showed the observer how by regulating the lights and shadows he could take very accurate readings with it. All the readings of the new barometer had better be rejected, and those of the old, which have been taken continuously side by side with the others, used in their place. The wet bulb thermometers had an incrustation of some thickness. The other instruments were in good order. The observer, Bapalal Metha, was trained by his predecessor, Corporal C. Barley, a year and a half ago. I pointed out to him all those parts of the instruction book which refer to third class observatories.

(*10*) *Neemuch.*—The barometer cistern was dirty inside, but it was quite possible to take correct readings. The fence round the radiation thermometers and raingauge was, I thought, too high; and the raingauge was protected by the sun thermometer stand. The wet bulbs of the thermometers were covered with sediment, but perhaps not more than was to be expected at Neemuch at that time of the year. The observer had covered them with lint instead of with muslin. The pointer of the anemometer was loose. The observer, T. Bachu, is a painstaking man, but he is very slow of understanding, and is scarcely able to discover for himself any irregularities that may occur in the instruments. He has recently become an attested military man, and is now liable to be removed for active service at any time.

(*11*) *Indore.*—The instruments were in good order, excepting that some of the thermometers required the graduation marks re-blackening. The anemometer was taken down and cleaned. The necessity for a tower for it is very great, as mentioned in last year's report, and I promised to make a sketch of what was required. The observer, Trimvakrao, who was trained by his predecessor, is an intelligent man, but for some reason or other his observations on two or three occasions have required very careful checking. I marked out for him those parts of the instruction book to which his attention was necessary, and tried to impress him with the importance of carefulness in his work.

(*12*) *Malegaon.*—Solomon Aaron, who succeeded Gopal Cuddum, had left Malegaon a few days before my arrival there. His work was very defective. He was succeeded by an observer who had been trained at Poona, and who appeared likely to do the work satisfactorily. I examined him carefully and instructed him where he needed it. The barometer No. 27-1868, by Adie, had for some time been suspected to be out of order, as the readings at Malegaon for the past three or four years had been abnormally high when compared with the surrounding stations. But its vacuum was very good, and I could find nothing wrong with it except that the cistern was dirty, and that it was placed in a bad light. Dr. Carson had a new and well-lighted place provided for it, and by the proper regulation of the lights and shadows it was possible to read it in its new position quite accurately. I had taken with me a new barometer to be left in place of the old one, but on unpacking it air was found in the upper end of the tube, and it had to be returned to Bombay. I took to pieces and cleaned the anemometer (one of the five wheel ones); it had been very badly put together by some one, so that it not only worked stiffly, but the worm and worm wheel had become very much worn.

(*13*) *Ratnagiri.*—Everything was in good order here. The anemograph tower, however, requires additional protection from the rain, which during the monsoon makes its way through the laterite stone of which the tower is built, and causes the recording room to be very damp.

(*14*) *Sholapur.*—Application was made in the month of July last for sanction to be granted to the transfer of the observatory at this station from the old site to the telegraph office; but it was requested that before sanction was granted enquiries should be made as to the permanency of the telegraph office in its present quarters. Sanction was granted. The Telegraph Master was sent to Bombay for training, estimates for the necessary buildings were prepared and sanctioned by the Bombay Government, a set of instruments was forwarded to the telegraph office, the Telegraph Master began to take barometer and general weather observations, and he trained a man to take the observations for a year at the old site; but when the Public Works Officer came to the point of putting up the anemometer tower and other observatory erections, it was found that the permanency of the telegraph office in its present quarters was quite uncertain. This discovery upset all the arrangements; and it is only after much difficulty that the matter has been satisfactorily settled. A young man has been found willing to serve as observer at the old site on the pay of Rs. 15 with the prospect of good work allowances; he engages to live near to the observatory, and to remain there for some years. The observatory, therefore, will continue at the old site.

The man trained by the Telegraph Master, was, I found, unable to read the barometer correctly, and his readings from November 1st to December 20th have had to be rejected, and those of the Telegraph Master used in their place. The instruments were all in good order, except the wind vane, which had to be sent to Bombay for repair.

The height of the barometer cistern at the new site was 1566-70 feet above the sea-level.

(*15*) *Karwar.*—The instruments here were in good condition. Trees grew too close to the raingauge enclosure, and I recommended they should be cut down. The site is not good for wind observations owing to the surrounding hills, and for this reason the anemometer had never been erected, but Mr. Westbrook, the Port Officer and Superintendent of the observatory, said he would have it placed near the light-house, in the position which had once been occupied by an anemograph erected in connection with the tidal operations; wind observations will therefore be taken by the light-house keeper. The observer here, G. W. M. D'Aranjo, is a careful and intelligent man, and his observations are always trustworthy.

(*16*) *Calicut.*—This observatory was established by the Bombay Office in connection with the Bombay Storm Warning System, and is not a regular observatory; it has, however, all instruments except radiation thermometers, and the observer gets the usual monthly allowance. The thermometers I found were hung in the Port Officer's Office, a small second floor room with windows in the north, west, and south walls; the hygrometer was hung on the south wall, and the maximum, and minimum thermometers on the east. The raingauge was on the north-east side of the Custom House, and I thought somewhat protected from the principal rain-bearing winds. It was fixed in a wooden frame-work, constructed after a local pattern. The anemometer was situated at the pier head in very good position; but it was fixed directly on to the ridge of a roof, contrary to express instructions, and was below the level of some neighbouring cranes. The entire re-arrangement of this observatory is under consideration; but there is difficulty in finding a suitable site.

* * * * * *

WORK OF THE SECOND CLASS OBSERVERS.

The work of the observers appointed to Deesa and to Poona has given satisfaction, and that of the Karachi observer was on the whole good, except that I had reason to believe he left a great part of the observational work to his assistant. Keshav Vishnu at Belgaum soon gave evidence that he cared very little for meteorological work, and would be glad to get rid of it; after holding his appointment for only three months he applied to resign; his application was refused, but he applied again and again, and finally, after he had trained his assistant to do both the observational and the computing work, he sent word that he intended to leave the department, and would draw no more pay, though, if I would not grant his application, he would be obliged to attend the office up to the end of the time I had fixed. After some precautions had been taken for the proper carrying out of his work by the assistant, he was allowed to resign; his work was not of a very high character, and his successor, it will be seen from the list of merit, has given greater satisfaction. In January 1884 the Karachi observer applied to resign; arrangements were made for training his assistant, who has since relieved him.

APPOINTMENT OF INDEPENDENT OBSERVERS TO THIRD CLASS STATIONS.

Great inconvenience has frequently been felt by the Meteorological Department in Western India in connection with those third class observatories at which the observers have been military medical subordinates. These observers have always been liable to frequent transfer in connection with their primary duties. It was seldom that notice of intended transfers reached the Meteorological Office, and it not unfrequently happened that men were appointed to these posts who were indifferently qualified for the work. In this way much extra correspondence has been entailed, and what is more serious, the character of the registers has sometimes suffered. I was induced, therefore, in January last to make certain proposals to the Surgeon General, Her Majesty's Forces, Bombay, with a view to preventing the breaks in the registers which resulted from these transfers, and to securing the appointment of only qualified observers. The ultimate result has been a decision to replace the military medical subordinates by independent men on the usual meteorological allowances whose primary work shall be the meteorological. This arrangement, if it be found workable, will be very satisfactory to the Meteorological Department, for not only will the character of the registers be improved, and (providing arrangements be made for relieving the observers during sickness) the interruptions be less frequent, but a great saving will be made in the work of the Bombay Office, as there will be less correspondence and less training of observers.

ALTERATIONS IN THE FACTORS OF INSTRUMENTS.

During my tours of inspection I compared the barometers and thermometers of all the observatories with the travelling standards; the results are given below—

STATIONS.	Barometer.	Dry bulb thermometer.	Wet bulb thermometer.	Dry maximum thermometer.	Dry minimum thermometer.	Wet minimum thermometer.	Grass radiation thermometer.
	Inch.	°	°	°	°	°	°
Kurrachee . .	Fallen ·011	Risen 0·3	Risen 0·2	Fallen 0·3	Fallen 0·1	Risen 0·1	......
Deesa . . .	,, ·008	,, 0·3	Fallen 0·3	Risen 0·4	0·0	Fallen 0·4	......
Poona . . .	,, ·005	,, 0·1	,, 0·0	,, 0·1	Fallen 0·1	,, 0·5	......

STATIONS.	Barometer.	Dry bulb thermometer.	Wet bulb thermometer.	Dry maximum thermometer.	Dry minimum thermometer.	Wet minimum thermometer.	Grass radiation thermometer.
	Inch.	°	°	°	°	°	°
Belgaum . . .	Fallen ·009	Risen 0·1	Risen 0·1	Risen 0·3	Fallen 0·1	Risen 0·1	Risen 0·4
Jacobabad . .	·000	„ 0·2	Fallen 0·2	......	Risen 0·1	Fallen 1·3	0·0
Hyderabad . .	Risen ·004	Fallen 0·1	Risen 0·2	Risen 0·2	„ 0·1	0·0	......
Bhuj . . .	Fallen ·016	Risen 0·2	0·0	„ 0·2	„ 0·4	Fallen 0·3	Risen 0·1
Surat . . .	Risen ·001	0·0	Risen 0·2	„ 0·2	„ 0·1	„ 0·4	......
Mount Abu . .	Fallen ·003	Risen 0·1	Fallen 0·5(?)	0·0	0·0	„ 0·1	Fallen 0·1
Neemuch . . .	Risen ·002	„ 0·2	Risen 0·2	0·0	0·0	„ 0·1	Risen 0·1
Indore . . .	Fallen ·005	0·0	„ 0·1	Risen 0·3	Fallen 0·2	„ 0·5	......
Malegaon . .	Risen ·008	Risen 0·3	Fallen 0·2	„ 0·1	0·0	0 0	......
Ratnagiri . .	Fallen ·003	„ 0·4	Risen 0·5	0·0	0·0	Fallen 0·3	0·0
Sholapur . . .	Risen ·002	„ 0·1	„ 0·2	0·0	Risen 0·2	„ 0·7	Risen 0·1
Karwar . . .	·000	„ 0·5	0·0	Risen 0·3	Fallen 0·1	„ 0·4	„ 0·1
Calicut . . .	Fallen ·004	„ 0·1	Fallen 0·1	„ 0·2	......	......	......

In the table of alterations of factors given in the Administration Report of 1882-83, the words "Fallen" and "Risen" were interchanged throughout, and some other errors of computation were made. The following is the revised and corrected table for that year:—

Alterations of Factors of Instruments in 1882-83.

STATIONS.	Barometer.	Dry bulb thermometer.	Wet bulb thermometer.	Dry maximum thermometer.	Dry minimum thermometer.	Wet minimum thermometer.	Grass radiation thermometer.
	Inch.	°	°	°	°	°	°
Karachi . .	Fallen ·011	Risen 0·3	Risen 0·2	Risen 0·1	Fallen 0·2	Fallen 0·1	Risen 0·2
Deesa . . .	„ ·005	„ 0·2	Fallen 0·2	„ 0·5	„ 0·1	?	......
Poona . . .	......	„ 0·2	Risen 0·1	„ 0·1	„ 0·1	Fallen 0·5	......
Belgaum . .	Fallen ·012	„ 0·2	„ 0·2	„ 0·4	0·0	......	Risen 0·4
Jacobabad . .	„ ·002	„ 0·1	Fallen 0·2	......	Risen 0·1	Fallen 0·8	„ 0·1
Hyderabad . .	Risen ·006	......	......	Risen 0·1	„ 0·4	Risen 0·1	0·0
Surat . . .	„ ·001	......	Risen 0·3	„ 0·1	0·0	0·0	Fallen 0·3
Mount Abu . .	No. 48 Fallen ·083	0·0	„ 0·1	„ 0·1	Risen 0·1	0·0	0·0
Mount Abu . .	No. 710 Fallen ·005	......	......	......	......	......	......
Neemuch . .	„ ·004	Risen 0·1	Risen 0·1	Risen 0·1	......	Fallen 0·3	......
Indore . . .	„ ·006	„ 0·1	0·0	„ 0·4	Risen 0·1	„ 0·3	......
Malegaon . .	Risen ·014	„ 0·1	0·0	0·0	„ 0·1	0·0	......
Ratnagiri . .	Fallen ·004	„ 0·2	Risen 0·5	Risen 0·1	Fallen 0·2	Fallen 0·5	?
Rajkot . . .	„ ·008	„ 0·1	0·0	„ 0·3	Risen 0·1	„ 0·8	Risen 0·5
Amraoti . . .	......	......	......	......	Fallen 0·3	Risen 0·1	Fallen 0·4

THE LIBRARY.

One hundred and eleven books were added to the library during the past year, making a total of 821. They have all been compared with the catalogue and found correct.

WORK OF THE BOMBAY OFFICE.

The work of the office has consisted of the usual receipt, correction, computation, and tabulation of the observations from the third class observatories, and the correction and tabulation of those from the second class observatories; the checking of these observations by means of actual and abnormal curves, and the examination of every discovered instance of erroneous or doubtful observation; the training and in some cases appointment of observers; the comparison and issue of instruments; the conducting of the storm-warning service; the receipt, arrangement, and in some cases translation from the vernaculars (but not the control) of rainfall returns from over 400 stations; the forwarding of the complete monthly returns to the Meteorological Reporter to the Government of India, and of the monthly abstracts published in the *Bombay Government Gazette;* the furnishing of special information to the public and to Government departments; the conducting of special investigations and research; the management of the finances of the department; and the conducting of the correspondence involved by all the above-mentioned works.

TRAINING OF OBSERVERS.

The following is the list of observers trained in the Bombay Office during the year 1883-84:—

Second Class .	Narayan Vinayek Raje finished his training on 19th April 1883 and was sent to Karachi.
	Minquel Fernandez was in training on the 31st March 1884, and was to be sent to Karachi.
Third Class .	Passed Native Medical Pupil Solomon Ezekiel obtained his certificate on the 9th July 1883.
	Telegraph Master R. P. Stephens, trained on 13th July 1883, and employed at Sholapur (new site).
	2nd Class Hospital Assistant Babaji Rawoot obtained his certificate on the 31st July 1883 and was subsequently employed at Jacobabad.

In addition to the above the following were trained locally:—

Second Class .	Ramchandra Datto trained at Belgaum by his predecessor in September 1883 and by the Acting Meteorological Reporter in March 1884, and was employed as observer on 12th September 1883.
Third Class .	Goolzar Sing trained by Telegraph Master R. P. Stephens at Sholapur, and employed at the old site on 1st November 1883.
	Shunker Rao trained by his predecessor and employed at Buldana on 1st June 1883.

* * * * * * *

The suggested arrangements referred to in last year's report, for the better exposure of the instruments at Goa, were submitted by Mr. Martins to the Goanese Government and sanctioned; and a request was made to the Meteorological Office by the Portuguese Consul in Bombay for assistance in obtaining the necessary thermometer cage, solar thermometer stand, and a grass thermometer pad. With the sanction of the Government of Bombay these articles were sold to the Consul from the stock in hand.

STORM-WARNING SERVICE.

No alteration in this service has been made during the past official year. Telegrams of the daily 10 hours observations have been received regularly from the following stations:—

Karachi.
Surat.
Ratnagiri.
Karwar.
Mangalore.
Calicut.
Cochin.
Negapatam.
Madras.
Masulipatam.

These, after reduction, have been, together with the observations from Bombay, curved and charted; and a written report of them has been daily posted up in the Port Office; also one copy of the report has been forwarded to the *Times of India*, and an abstract of it to the *Bombay Gazette.* Besides these regular telegrams, special ones, have been called for on special occasions.

Telegrams of a cautionary or re-assuring nature, or instructing that the storm-signals should be hoisted, have been issued as follows:—

Names of Ports.	Dates on which the telegrams were sent to hoist storm-signals.	Dates on which Cautionary telegrams were sent.	Date on which Re-assuring telegrams were sent.
Karachi . .	3rd July 1883	24th and 29th April, 22nd May, 3rd and 29th June, 2nd July, 19th October, and 11th November 1883.	4th July 1883.
Bhávnagar .	3rd July „	24th April, 22nd May, 2nd July, 19th October, and 11th November 1883.	......
Daman . .	3rd July „	24th April, 22nd May, 2nd July, 19th October, and 11th November 1883.	......
Bombay . .	......	25th June 1883.	......
Goa . . .	......	2nd May and 5th October 1883.	......
Vingorla . .	......	2nd May 1883.	......
Kárwár . .	......	2nd May and 5th October 1883.	......
Kumta . .	......	2nd May 1883.	......

As will be seen from the above list, the only storm of sufficient violence to make it necessary to hoist the storm-signals was that which crossed the peninsula at the end of June and beginning of July.

During my absence on tour, Mr. F. Chambers, the Acting Superintendent of the Government Observatory, Colaba, examined the daily weather charts and reports, and advised the office as to the calling in of special telegrams and the issue of storm-warnings.

The telephone which was fixed in the meteorological office in the month of August 1882, and is connected with the Bombay Central Telegraph Office, has, with the exception of two or three occasions, worked satisfactorily.

SPECIAL WORK.

A brief sketch of the meteorology of the Bombay Presidency in 1882-83 was prepared in September last for the Bombay Government. During the writing of this sketch I made some discoveries of quantitative relations which had existed between previous and subsequent barometric movements in Western India during the years 1870 to 1883. I followed up these discoveries in a paper entitled "Some Results of an Examination of the Barometric Variations in Western India," which was submitted to the Royal Meteorological Society in February last, and has since been read at one of their meetings. The paper written by me last year on the "Transmission Eastwards round the Globe of Barometric Abnormal Variations" was published in *Nature* of August the 9th and 16th, 1883. I have worked out in detail and made complete drawings of the design for a component anemograph, of which mention was made in last year's report. I have also invented an entirely new form of vane, the object of which is to work with scarcely any friction, and yet without oscillation. I have also introduced some improvements into the design for the support of the anemograph cups. Drawings of the cups and vane, together with those of the resolving and recording apparatus, have been submitted with a descriptive paper to the Royal Meteorological Society. I have also been engaged in an investigation of the barometric abnormals of Malegaon, and have obtained results which seem to throw light on the question of reduction to sea-level of barometric values at plateau stations. I have not yet been able to work up these results in the form of a paper.

Out-of-office hours I have made some comparisons between the meteorological and the health statistics of Bombay; but the fact pointed out in one of the recent reports of the Health Officer that the Health Statistics of Bombay are influenced in a very important degree by emigration, and that, until recent years, this fact had not been taken into consideration in compiling the Health Statistics, led me to desist for the time being from further labour on the subject.

* * * * * *

OFFICE ESTABLISHMENT.

I remained acting as Meteorological Reporter for Western India up to the 6th June 1883, on which date, Mr. F. Chambers, the permanent incumbent, returned to duty. He held charge of the office up to the 18th June, when he was appointed to act as Superintendent of the Government Observatory, Colaba, and I, having been appointed by the Government of India to "continue" acting as Meteorological Reporter, resumed charge of the Meteorological Office. My appointment was subsequently sanctioned by the Secretary of State for India.

The other members of the office staff at the end of the year were as follows:—

Name.	Monthly Pay.
FOR LAND METEOROLOGY.	Rs.
Ganesh Sadashiv	57
Vajeram Jeeharam	42
Mahadev Ramchandra	40
Krishnaji Ramchandra	30
Ramchandra Sadashiv	30
FOR STORM-WARNING SERVICE.	
Ramchandra Govind	30
Anant Vishvamber	30

There is one menial on Rs. 10 per month; and a peon on Rs. 10 per month was sanctioned by the Government of India and engaged on the 11th August 1883.

I have during the year forwarded to Mr. Blanford a detailed statement of the work done by the office, and have asked his favourable consideration to certain proposals for an increase, both in the number of clerks and in the scale of pay of the present staff. It is difficult to see how the work of the office can be reduced to any useful extent without prejudicing the character of the meteorological returns. Great attention has always been paid to checking the observations; indeed this is, next to the computation, the most time-absorbing work in the office.

I have had every reason to be satisfied with the work of the clerks; they have all worked intelligently, and with care and diligence.

In conclusion, the thanks of the department are due to the various medical officers in charge of the observatories, many of whom have rendered valuable assistance.

A. N. PEARSON,
Acting Meteorological Reporter for Western India.

METEOROLOGICAL OFFICE, BOMBAY,
The 24th June 1884.

APPENDIX F II.

Names of the Superintendents and of the Observers who have officiated at the Observatories in Western India during the year 1883-84.

STATION.	Class.	Superintendent.	PERIOD.		Observer.	DATE.		REMARKS.
			From	To		From	To	
Karachi	Second	Surgeon-Major J. Paxton	1st April 1883	26th Mar. 1884	Private F. Bateman	1st April 1883	27th April 1883	
		Surgeon D. O. Sullivan	27th Mar. 1884	31st Mar. „	Narayen Vinayek Raje	28th April „	31st Mar. 1884	
Deesa	Ditto	Surgeon-Major F. Lyons	1st April 1883	9th July 1883	Ramkrishna Keshav Karandiker	1st April „	31st Mar. „	
		Surgeon G. J. Ward	10th July „	8th Oct. „				
		Surgeon-Major F. Lyons	9th Oct. „	31st Oct. „				
		Surgeon G. J. Ward	1st Nov. „	28th Nov. „				
		Surgeon-Major F. Lyons	29th Nov. „	14th Feb. 1884				
		Surgeon C. B. Maitland	15th Feb. 1884	23rd Feb. „				
		Surgeon-Major F. Lyons	24th Feb. „	31st Mar. „				
Yerrowda (Poona)	Ditto	Ditto S. M. Salomon	1st April 1883	31st Mar. „	Narayen Sakharam Kelkar	1st April „	31st Mar. „	
Belgaum	Ditto	Ditto R. P. Ferguson	1st April „	31st Mar. „	Keshav Vishnu Apte	1st April „	11th Sep. 1883	
					Ramchandra Datta	12th Sep. „	31st Mar. 1884	
Jacobabad	Third	Surgeon J. McCloghry	1st April „	9th April 1883	Naryen Mane	1st April „	13th Sep. 1883	
		Ditto B. N. Koyaji	10th April „	18th April „	No Observer	14th Sep. „	16th Sep. „	
		Ditto K. H. Mistri	19th April „	2nd June „	Babajee Rawoot	17th Sep. „	31st Mar. 1884	
		Ditto B. N. Koyaji	3rd June „	31st Mar. 1884				
Bickaneer	Ditto	No Superintendent	……	……	Ram Lall	1st April „	31st Mar. „	
Hyderabad (Sind)	Ditto	Surgeon-Major H. M. Macbeth	1st April 1883	31st Mar. 1884	V. E. Nazareth	1st April „	31st Mar. „	
Bhuj	Ditto	Surgeon W. A. Barren	1st April „	31st Mar. „	Mahesh Bux Sing	1st April „	31st Mar. „	
Mount Abu	Ditto	Surgeon-Major Charles White	1st April „	29th Oct. 1883	Bapalal Mehta	1st April „	31st Mar. „	
		Ditto H. T. Chapman	30th Oct. „	28th Dec. „				
		Ditto Charles White	29th Dec. „	31st Mar. 1884				
Neemuch	Ditto	Ditto J. R. Croker	1st April „	30th April 1883	T. Bachu	1st April „	31st Mar. „	

		Sugreon S. J. Flood.	1st May ,,	31st May ,,			
		Surgeon-Major J. R. Croker	1st June ,,	31st Mar. 1884			
Indore	Ditto	Ditto D. F. Keegan	1st April ,,	31st Mar. ,,	Trimbakrao	1st April ,,	31st Mar. ,,
Rajkote	Ditto	Ditto S. B. Haliday	1st April ,,	20th Mar. ,,	Solomon Samuel	1st April ,,	16th Jan. ,,
		Surgeon S. T. Avetoon	21st Mar. 1884	31st Mar. ,,	Keshav Govind	17th Jan. 1884	31st Mar. ,,
Surat	Ditto	Surgeon-Major J. Robb	1st April 1883	31st Mar. ,,	Dhunjibhai Motabhai	1st April 1883	31st Mar. ,,
Akola	Ditto	Surgeon J. J. Moran	1st April ,,	31st Mar. ,,	Samuel Gregory	1st April ,,	31st Mar. ,,
Amraoti	Ditto	Ditto T. Hume	1st April ,,	31st Oct. 1883	Mahomed Samsudin	1st April ,,	1st April 1883
		Apothecary W. E. Hendricks	1st Nov. ,,	30th Nov. ,,	Bukaram Pandrang	2nd April ,,	31st Mar. 1884
		Surgeon T. Hume	1st Dec. ,,	31st Mar. 1884			
Chikalda	Ditto	Ditto C. L. Swaine	1st April ,,	2nd Jan. ,,	Hiralal	1st April ,,	31st Mar. ,,
		Ditto R. James	3rd Jan. 1884	31st Mar. ,,			
Buldana	Ditto	Apothecary D. Callaghan	1st April 1883	31st Mar. ,,	Pandurang Krishnaji	1st April ,,	31st May 1883
					Shunker Ramrao	1st June ,,	31st Mar. 1884
Malegaon	Ditto	Surgeon P. J. Damania	1st April ,,	11th Dec. 1883	Gopal Cuddum	1st April ,,	11th Dec. 1883
		No Superintendent	12th Dec. ,,	5th Feb. 1884	Solomon Aaron	12th Dec. ,,	31st Mar. 1884
		Surgeon M. Collie	6th Feb. 1884	19th Feb. ,,			
		Ditto W. P. Carson	20th Feb. ,,	31st Mar. ,,			
Sholapur	Ditto	W. R. Scroggie, Esq., L.R.C.P.	1st April 1883	31st Mar. ,,	Atmaram Bapuji	1st April ,,	31st Oct. 1883
					Gulgarsing Luxman Sing	1st Nov. ,,	31st Mar. 1884
Ratnagiri	Ditto	Surgeon H. McCalman	1st April ,,	25th Sep. 1883	Mahadev Cuddum	1st April ,,	31st Mar. ,,
		Ditto Arthur Sargent	26th Sep. ,,	27th Mar. 1884			
		Ditto H. McCalman	28th Mar. 1884	31st Mar. ,,			
Zanzibar	Ditto	Ditto M. L. Bartholomeuz	1st April 1883	26th Nov. 1883	Surgeon M. L. Bartholomeuz	1st April ,,	20th April 1883
		No Superintendent	27th Nov. ,,	31st Mar. 1884	Abdur Rehman	21st April ,,	31st Mar. 1884
Karwar	Voluntary	R. G. C. Westbrook, Esq.	1st April ,,	31st Mar. ,,	G. W. M. D'Aranjo	1st April ,,	31st Mar. ,,
Calicut	Storm-warning Service.	Henry Richardson, Esq.	1st April ,,	31st Mar. ,,	F. D'Rozario	1st April ,,	31st Mar. ,,

APPENDIX G.

Extracts from the Administration Report of the Meteorological Reporter to the Government of Madras for the year 1883-84.

During the official year under report observations were recorded as usual three times daily, *viz.*, at 10 A.M., 4 P.M., and 10 P.M., at twelve observatories, and twice daily, leaving out the 10 P.M. records, at 5 third class observatories. A new third class observatory was opened at Cuddapah on the 23rd of March 1884, and fresh instruments were provided wherever needed. Three of the observatories were inspected during the year.

A copy of the Madras Observatory Meteorological Register for each month is handed over to the Meteorological Reporter for the Presidency, which obviates the necessity of a separate record being maintained. No changes were made in the instruments used during the year. The following are the observatories which furnish meteorological registers :—

Madras.
Amini Divi.
Bangalore.
Bellary.
Cochin.
Coimbatore.
Cuddapah.
Kurnool.
Madura.
Mangalore.
Masulipatam.
Mercara.
Negapatam.
Rajahmundry.
Salem.
Secunderabad.
Trichinopoly.
Wellington.

Amini Divi (*Laccadives*).—The observations taken at this observatory were still very unsatisfactory, and the records that can be utilised this year are those of the barometer and dry and wet bulb thermometers.

The remuneration allowed to the Hospital assistant for his meteorological duties was withdrawn last year when the observations proved so unreliable, and he has since been transferred to another station, but, prior to this change, his successor, Syed Laul, was permitted by the Medical Department to attend my office for instruction in the additional meteorological work required. He came daily for about a month, during which time he was also taught to reduce the observations. The pay of the assistant at this observatory has been doubled, conditionally, that is, if the records and reductions prove satisfactory on revision at the Madras Office. A fresh anemometer was sent to Amini Divi by the new assistant, but, on arriving at his destination, he reported that one of the cups had come off.

Bangalore.—As usual, the work at this observatory has been very good throughout the year. No new instruments were required; the records were unbroken, and the assistant reduced and forwarded his observations with care and punctuality.

Bellary.—The ordinary observations three times a day; hourly observations on four days in each month, and the synoptic observations taken at the local time, corresponding to 7 A.M., Washington mean time, for the "United States International Weather Bulletin" were all carried on satisfactorily throughout the year.

I inspected this observatory on the 21st, 22nd, and 23rd of March last. The barometer was clean and in very good order, but the room in which it is placed is rather too small. The thermometer shed required a good many alterations, but, as Dr. Archdall informed me that it was under consideration to remove the Civil Dispensary some little distance off, and that all the meteorological instruments will have to be disturbed, I thought it better to defer the less important improvements till later on. The thatching on the roof of the shed was scarcely thick enough, and the sides, instead of being open, were screened off by mats to within 3 feet of the south end, which, of course, prevented the free circulation of air. This, however, was soon taken down and set right, as at other observatories. Instead of neat posts and tarred ropes of telegraph wires to protect the shed and instruments from cattle, &c., there were only unsightly bamboo posts and string; these, however, will remain until the change. With the exception of the wet minimum, the thermometers were in fair order. * * * * As at all other observatories lately inspected, I substituted a teakwood thermometer cage for the open board on which the instruments had hitherto been placed, but only found it necessary to change one thermometer, the wet minimum. The assistants have worked better this year, reducing their observations thoroughly, but the delay in forwarding the reduced registers to me, frequently, six months in arrears, has still been a matter of complaint and serious inconvenience. In other respects I believe both the assistants do their best. No grass thermometer pad has ever been in use at this observatory, and, as there was not the least appearance of any grass under the thermometer, I think this fact accounts in a measure for the readings of the latter instrument sometimes exceeding those of the wet minimum. The present position of the thermometer shed is not a good one, being too near the Civil Dispensary, nor do I consider the anemometer sufficiently high. The new site pointed out to me by Dr. Archdall will doubtless be a great improvement upon the old one, being more open, and the anemometer will, it is hoped, also be raised a few feet, so that the surrounding trees will have no effect upon its readings.

Cochin.—The observations at this observatory have been continuous throughout the year, with the exception of the grass minimum thermometer, which was broken on the 30th of April, and could not be replaced owing to the insufficiency of the instruments in store at Madras. The readings of the anemometer are still unreliable, and, though a new instrument by Casella, previously compared with the Madras Observatory anemograph, was supplied, there was no improvement in the records. On further enquiry I was informed that the position of the instrument was most unsuitable, being fixed to the northern pole of the shed and only about 2 feet higher. There is also a near building almost facing the shed, and a large tree within a few yards; these, no doubt, prevent any accurate measurements of the velocity. I intend inspecting this observatory before long, when I hope to remedy the defects and make such improvements as may be found desirable.

The assistant employed at this observatory since November 1880 was transferred to the Madras Office in August, and M. V. Eippe appointed in his place. This new assistant. formerly employed in the Postal Department, had undergone the usual instruction at this office while on privilege leave, and since joining his appointment has worked very creditably.

Coimbatore.—The work at this observatory has been satisfactory throughout the year. The barometer and thermometers were in good order, and no new ones required. The anemometer is worn, and needs replacing, but its position is not satisfactory: and pending the construction of a staging on which the new instrument can be placed, the old one has been recorded. The assistant has reduced his observations regularly and carefully, and has been allowed to remain in the service a few months longer, though his age now necessitates early retirement.

Cuddapah.—A new third class observatory was started at this station on the 23rd of March 1884. A thermometer shed of the usual dimensions and design, together with as many instruments as were available from this office, were sent in charge of T. Vythianatha Iyer, first assistant, who, with the aid of the Executive Engineer, saw the shed erected, placed the thermometers in the cage, and taught an assistant the duties required of him. On the 25th of March I inspected this observatory myself, and was very well satisfied with all the arrangements. The shed occupies a good open position at the east end of the hospital compound, and there are fortunately neither trees nor buildings near enough to have any effect upon the readings of the instruments. As there were no good barometers, or sun and grass thermometers in store at Madras, the Meteorological

Reporter to the Government of India was requested to furnish these instruments from Calcutta, but they had not arrived at the time of my inspection. The medical officer in charge showed me the room in which he proposed placing the barometer, a very suitable one in every respect, and the instrument has since been received and placed there. The height of the cistern of the barometer, as ascertained by the Executive Engineer, is 433·36 feet above mean sea-level. The assistant appointed to take the observations is a man who can give his whole time to the meteorology, and will not be liable to be changed. The system of employing men who have other duties to perform and are likely to be transferred, has proved very objectionable and detrimental to one or two observatories of this Presidency, and, as there are numbers of applicants for vacant posts, I find no difficulty in getting assistants upon Rs. 15 per month. No anemometer is in use at this station at present, but, as it is proposed to place this instrument on the roof of the hospital, an inexpensive stand and ladder will be all that is necessary, and I hope this will soon be ready, and the records of all the instruments rendered complete.

Kurnool.—The work at this third class observatory was carried on steadily till October 1883 when the telegraph master was transferred, and a native postmaster, who had received no instructions regarding the observations, took charge. Since then the maximum readings of the thermometer have been unreliable, and the whole work deteriorated. Postmoster V. Venhataseshazza has applied to me to be allowed to resign his meteorological duties, and as soon as a new assistant, now under instruction at my office, is qualified, he will relieve the present postmaster. As the new assistant will have no other work, I shall be able to report more satisfactorily regarding this observatory in future reports.

Madura.—A break in the records of the wet bulb thermometer occurred from the 5th of March 1883 till the 4th of June, when another was supplied, but with this exception there has been no change in this observatory during the year.

Mangalore.—The work of this observatory has been carried on without interruption throughout the year, and the instruments appear to have been kept in good order, and no new ones required, Weekly records of the observations are forwarded to me by the telegraph master in charge.

Masluipatam.—The work at this observatory has been carried on without any breaks in the records, but the barometric readings were evidently wrong for some time, and though a new instrument was supplied from Calcutta in March of this year, there has been little improvement. The assistant only reduced his observations for two or three months during the year, and even then they were so incorrect that I had to set the Madras Meteorological Office assistants to do the work over again for those months. Since March his salary has been reduced to half, but even this has failed to realise any improvements, and, in consequence, he will soon be superseded by a more competent and willing man.

Mercara.—No new instruments were needed at this observatory, and the work has been carried on in a satisfactory way throughout the year. Weekly records of the observations are regularly furnished to this office.

Negapatam.—The observations were carried on without any interruption throughout the year, and the instruments appear to have been in good order. During heavy rain the readings of the grass mininum have occasionally exceeded those of the wet minimum by a degree or even more. The assistant has worked well, reducing his observations more carefully than formerly.

Salem.—This observatory has kept its good reputation throughout the year. No new instruments were required, and the assistant has reduced his observations satisfactorily and forwarded them punctually to this office.

Secunderabad—This observatory was inspected on the 17th of March last, when I altered the arrangement of the thermometers, exchanging the thermometer board hitherto in use for a teakwood and wire cage, similar to those now used at all the observatories visited since the Department has been under my care. The general condition of the observatory was very satisfactory and highly creditable to both the medical officer in charge and his assistant. The barometer and all the other instruments were clean and in perfect order. The shed will require renovating and painting before long, and the railings which enclose the raingauge and radiation thermometers will be better extended right round the shed to prevent cattle when grazing near, from making an occasional meal of the thatching from the roof (an estimate for this little improvement had been submitted to me prior to my visit), and I understand the assistant has frequently had to watch the shed to prevent this from occurring. With the exception of the dry maximum thermometer, which was replaced by another in December, and the sun maximum thermometer broken in January, the remaining instruments were in good order throughout the year. The observations have been carefully and accurately reduced by the new assistant since his appointment, and this observatory, formerly the worst, now ranks as one of the best in the Presidency.

Trichinopoly.—The observations of this second class observatory have been carried on without any breaks all through the year under report, but the continued obstinacy of the assistants in not furnishing this office with the reductions till many months have elapsed is still a source of complaint, and has even delayed the publication of this Annual Report, as the table of yearly means and extremes cannot be completed until all the registers from up-country observatories have been received and revised.

Wellington.—No changes have been made in any of the instruments in use at this observatory, and the work has been carried on satisfactorily throughout the year, with the exception of three days in December, the 8th, 9th, and 10th, on which occasions the records were missed, owing to the indisposition of the acting assistant during the absence, on leave, of Serjeant Brownsell. As the medical authorities required the room which had hitherto been given up to the assistant as a meteorological office, and in which the barometer had been kept, this instrument was removed to another room on the same floor, at the back of the hospital after the 10 P.M. reading on the 31st of January.

The general work of the observatories of the Madras Presidency has been satisfactory during the year. With the exceptions of Cochin and Kurnool there have been no changes in the assistants. The observations have been reduced, some partially and others completely, by all the assistants, excepting the one at Masulipatam, and since the commencement of 1884 I am pleased to be able to report a still further improvement with regard to the registers. It has, however, been a difficult matter to get the assistants drawing the higher rate of salary to complete their work, and the inaccuracy of some of the figures at first necessitated complete revision at my office.

The list of new instruments supplied is considerably smaller this year when compared with that in last year's report.

* * * * * *

The establishment of the Madras Meteorological Office has been increased by the sanction of a copying clerk, a very necessary addition, and one that will enable me to keep the work up to date in future. The following is the present staff employed at my office :—

T. Vythianatha Iyer	First Assistant.
N. E. Kangayam Pillay	Second ,,
N. Narayansawmy	Third ,,
David John	Fourth ,,
Bungaroo	Peon.

Revenue Board Rain Reports have been received as usual by the Government Astronomer, and the results tabulated in the Supplement to the *Fort St. George Gazette* * * * * * * The rain stations have not yet been handed over to the Meteorological Reporter.

ELIZABETH ISIS POGSON, F. R., MET. SOC.,
Meteorological Reporter to the Government of Madras.

METEOROLOGICAL OFFICE,
Madras, 15th July 1884.

APPENDIX G II.

List of Officers in charge and Assistants in the Madras Presidency, Meteorological Department, in the official year 1883-84.

Station.	Officer in charge.	From	To	Assistant.	From	To
Amini Divi	Syed Abdool Rahaman	22nd Dec. 1879	5th Feb. 1884.			
	Syed Laul	6th Feb. 1884	31st Mar. ,,			
Bangalore	Surgeon P. H. Benson, M.B.	1st April 1881	14th Sep. 1883	Rungasawmy Moodeliar	1st Sep. 1871	31st Mar. 1884.
	,, A. F. Dobson, M.B.	15th Sep. 1883	19th Feb. 1884.			
	Surgeon-Major J. North	20th Feb. 1884	31st Mar. ,,			
Bellary	,, H. M. G. Archdall	11th Feb. 1881	31st Mar. ,,	B. G. Sashachellum, First	31st Aug. 1878	31st Mar. ,,
				Sreenevasa Row, Second	21st Dec. 1881	31st Mar. ,,
Cochin	Brigade-Surgeon W. H. Morgan	24th May 1882	31st Mar. ,,	G. Narayanasawmy	7th Nov. 1880	17th Aug. 1883.
				M. V. Eippe	18th Aug. 1883	31st Mar. 1884.
Coimbatore	Surgeon-Major J. F. Fitzpatrick, M.D.	2nd May ,,	31st Mar. ,,	Varadiah Naidu	1st July 1877	31st Mar. ,,
Cuddapah	Surgeon G. Iyasawmy	15th Mar. 1884	31st Mar. ,,	V. A. Vyaravalu Moodeliar	15th Mar. 1884	31st Mar. ,,
Kurnool	Telegraph Master A. Wale	12th Feb. 1883	12th Aug. 1883.			
	,, ,, A. Holmes	13th Aug. ,,	19th Oct. ,,			
	Post and Telegraph Master V. Venkatase-shazza.	20th Oct. ,,	31st Mar. 1884.			
Madura	Surgeon Major W. J. Hastings, M.D.	16th Oct. 1882	31st Mar. ,,	V. Sashachellum	19th Nov. 1867	31st Mar. ,,
Mangalore	Telegraph Master F. D'Souza	22nd Aug. 1880	17th Jan. ,,			
	,, ,, A. Ramarow	18th Jan. 1884	9th Feb. ,,			
	,, ,, R. S. D'Souza	10th Feb. ,,	31st Mar. ,,			
Masulipatam	Surgeon H. St. Clare Carruthers	9th April 1882	8th Nov. 1883	Uma Ranganayakulu Naidu	1st Aug. 1868	31st Mar. ,,
	Surgeon-Major J. H. Ritchie	9th Nov. 1883	31st Mar. 1884.			
Mercara	Telegraph Master H. Duckworth	29th Mar. 1880	21st Jan. ,,			
	Deputy Tel. Master T. S. Arunachellum	22nd Jan. 1884	26th Jan. ,,			
	Telegraph Master H. Duckworth	27th Jan. ,,	3rd Mar. ,,			
	Deputy Tel. Master T. S. Arunachellum	4th Mar. ,,	18th Mar. ,,			
	Telegraph Master H. Duckworth	19th Mar. ,,	31st Mar. ,,			

List of Officers in charge and Assistants in the Madras Presidency, Meteorological Department, in the official year 1883-84.

Station.	Officer in charge.	From	To	Assistant.	From	To
Negapatam	Surgeon E. A. Morris, L.R.C.P.	15th Nov. 1880	31st Mar. 1884	S. Saminatha Iyer	5th Sep 1874	31st Mar. 1884.
Salem	Surgeon-Major H. J. Haziett	26th May 1882	......	L. Ramsing	13th Oct. 1880	31st Mar. ,,
	Do. A. L. Hackett	......	31st Mar. 1884.			
Secunderabad	Do. E. Fawcett, F.R.C.S.	1st April 1883	6th April 1883	J. F. Williams	27th Feb. 1882	31st Mar. ,,
	Surgeon G. F. Bevan	7th April ,,	6th July ,,			
	Surgeon-Major E. Fawcett, F.R.C.S.	7th July ,,	12th Oct. ,,			
	Do. T. C. H. Spencer	5th Nov. ,,	7th Nov. ,,			
	Surgeon G. F. Bevan	8th Nov. ,,	14th Dec. ,,			
	Surgeon-Major T. C. H. Spencer	15th Dec. ,,	31st Mar. 1884.			
Trichinopoly	Do. J. B. Thomas, L.R.C.P.L.	3rd Dec. 1879	12th July 1883	T. Lutchman Row, First	21st Nov. 1874	31st Mar. ,,
	Surgeon J. L. Evan Gezzel, M.D.	13th July 1883	26th July ,,	E. M. Bhajarajooloo Naidee, Second	1st December 1881	31st Mar. ,,
	Surgeon-Major L. C. Nanney	27th July ,,	31st Mar. 1884.			
Wellington	Do. A. Long, M.D.	3rd Nov. 1882	24th Oct. 1883	Sergeant H. Brownsell	1st August 1880	31st Mar. ,,
	Surgeon R. T. Beamish, M.D.	25th Oct. 1883	16th Nov. ,,			
	Surgeon-Major C. F. Churchill, M.D.	17th Nov. ,,	31st Mar. 1884.			

APPENDIX H.

Report on the Administration of Meteorological Observatories in British Burma by the Sanitary Commissioner.

During the year all the Observatories in the province were inspected by me—

2nd class, Rangoon, on 12th February 1884.
3rd class, Bassein, on 13th and 14th June 1883.
3rd class, Thayetmyo, on 12th October 1883.
3rd class, Moulmein, on 20th December 1883.
3rd class, Mergui, on 9th December 1883.
3rd class, Toungoo, on 2nd August 1883.

The position of the last-named has since my inspection been changed from the Military Hospital Compound to that belonging to the Civil Dispensary.

All records were found up to date and appeared to be accurately kept.

Instruments, with the following exceptions, were clean, well-placed, and in good working order.

At Rangoon the clock-work in connection with the anemograph had stopped since 10 A.M. on the day of inspection. The observer explained that cockroaches and other vermin constantly get amongst the gearing and bring the clock-work to a standstill. Such alterations were recommended as, it is hoped, will prevent a recurrence of similar accidents. The wind-vane appeared to be working stiffly, and an officer of the Public Works Department was asked to put it to rights.

At Bassein the solar radiation thermometer had been broken by a monkey. It has since been replaced.

At Mergui the grass radiation thermometer had been broken by a piece of bone believed to have been dropped by a crow or other large bird.

At Moulmein, the grass radiation thermometer had been accidentally broken.

The accompanying lists show—

(*a*) The Superintendents and Observers for the year.
(*b*) The instruments issued to each Observatory.*

D. SINCLAIR, M.D.,
Sanitary Commissioner, British Burma.

RANGOON,
5th July 1884.

---

* This is incorporated in the general return in Appendix K.

APPENDIX H II.

Return showing the names of Superintendents and Observers of the Meteorological Observatories in the Province of British Burma for the year 1883-84.

Name of Station.	Designation of Officer.	Name and Rank of Officer.	Term of Service.
Rangoon . .	Superintendent .	Surgeon-Major H. Johnstone, M.D.	From 22nd April 1880 to 27th August 1883.
	Offg. Ditto . .	Ditto O. Baker . .	„ 28th August to 27th November 1883.
	Ditto . .	Ditto H. Johnstone, M.D.	„ 28th November and 29th November 1883.
	Offg. Ditto . .	Ditto O. Baker . .	„ 30th November 1883 to 15th January 1884.
	Superintendent .	Ditto H. Johnstone, M.D.	„ 16th January to 31st March 1884.
	Observer . .	G. E. Wales	„ 1st August 1882 to 31st March 1884.
	Assistant Observer .	Meh Nego	„ 1st December 1882 to 15th September 1883.
	Ditto . .	O. White	„ 16th September 1883 to 31st March 1884.
Bassein . .	Superintendent .	Surgeon S. H. Dantra, M.D. . .	„ 1st November 1881 to 31st March 1884.
	Observer . .	Moung Hpay	„ 14th February 1883 to 31st March 1884.
Thayetmyo .	Superintendent .	Surgeon O. Baker . . .	„ 1st April to 25th August 1883.
	Ditto . .	Ditto E. P. Frenchman . .	„ 26th August 1883 to 26th February 1884.
	Ditto . .	Ditto Charles W. E. Foster .	„ 27th February to 31st March 1884.
	Observer . .	Mirza Mahomed Tphya Begg, 3rd Class Hospital Assistant.	„ 1st April to 31st December 1883.
	Ditto . . .	Alla Deen, 2nd Class Hospital Assistant.	„ 1st January to 31st March 1884.
Moulmein . .	Superintendent .	Surgeon-Major W. F. de Fabeck, M.D., Civil Surgeon.	Throughout the year.
	Observer . .	F. St. Hilbert, Hospital Assistant .	
Mergui . .	Superintendent .	Hospital Assistant Rajub Ally .	From 1st to 13th April 1883.
	Ditto . .	Uncovenanted Medical Officer, Paul George Paul.	„ 14th April 1883 to 31st March 1884.
	Observer . .	Moosajee	„ 1st April 1883 to 31st March 1884.
Tounghoo . .	Superintendent .	Surgeon Maurice Smith . .	„ 1st April to 30th July 1883.
	Ditto . .	Ditto P. W. Dalzell . . .	„ 31st July to 31st March 1884.
	Observer . .	1st Class Hospital Assistant M. Baboo Pillai.	„ 1st April 1883 to 31st March 1884.

D. SINCLAIR, M.D.,
Sanitary Commissioner, British Burma.

APPENDIX I.

Return of the Stock and Issue of Instruments for the year 1883-84.

Instruments.	In Store on 1st April 1883.	Received 1883-84.	Issued 1883-84.
Van Rysselberghe's meteorograph	1	...	...
Barometers, observatory, Fortin's principle	8	5	5
Do. do. Kew principle	3	28	23
Do. mountain, portable tripod (Adie)	18	5	11
Do. marine, Kew principle	22	1	14
Do. Newman's, large standard	2	...	...
Do. do. small standard	3	3	4
Do. Negretti and Zambra (various)	7	2	5
Aneroids	19	2	2
Thermometers standard with attached scales	20	...	3
Do. without attached scales (chemical)	1	...	...
Do. for hygrometers (Kew pattern)	80	52	63
Sling thermometers	10	...	...
Thermometers, maximum, for shade	123	16	51
Sun thermometers not in vacuo	2	...	...
Thermometers minimum for shade	52	44	46
Do. do radiation	31	25	33
Six's thermometers	...	6	...
Thermometers, solar, in vacuo	38	33	13
Frankland's sun thermometer	...	6	1*
Ponillet's pyrheliometer	1	...	...
Stewart's actinometers (thermometers for)	...	12	12
Lenses for actinometers	...	3	3
Hodgkinson's do.	2	...	...
Herschell's do.	1	...	...
Regnault's hygrometer	3	...	...
Daniell's do.	10	...	...
Halleur's do.	5	...	...
Boiling point thermometers	6	1	...
Pocket spectroscopes (Browning's)	2	...	...
Wind vanes	17	14	23
Anemometers	26	45	43

* Broken.

Return of the Stock and Issue of Instruments for the year 1883-84—continued.

Instruments.	In Store on 1st April 1883.	Received 1883-84.	Issued 1883-84.
Beckley's anemographs	2	...	...
Raingauges (Symons' and Glaisher's)	6	37	33
Measure glasses for do.	18	72	55
Reading lenses	3	1	3
Sun thermometer stands	20	...	6
Radiation pads	3	5	8
Thermometer cages	4	27	28
Do. for ships	15	...	...
Prismatic compass	1	...	...
Sand glasses (3 minutes)	5	80	39
Sunshine recorder	1	...	...
Bull's eye lantern	1	...	...
Salinometers	36	...	...
Common thermometers, brass scales	28	...	1
Clocks	2	8	8
Watches	...	2	1
Spirit level	1	...	...
Hick's barograph	1	...	...
Thermograph with Negretti's and Zambra's sets of recording thermometers	1	...	...
Sundials	...	2	2
Magnetic compasses (pocket)	...	4	4

APPENDIX K.

Return of the Instruments issued to each Observatory in 1883-84.

Provinces.	Stations.	Barometers.	Hygrometers.		Dry maximum thermometers.	Minimum thermometers.		Radiation thermometers.		Anemometers.	Wind Vanes.	Raingauges.	Measure-glasses.	Lenses.	Clocks.	Sand-glasses.	Stands for sun thermometers.	Pads for grass radiation thermometers.	Cages.	Standard thermometers.	Compasses.	Sundials.	Remarks.
			Dry bulb.	Wet bulb.		Dry.	Wet.	Solar.	Grass.														
Africa.	Zanzibar	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1*	...	* In lieu of one lost.
Persia.	Bushire	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	
Beloochistan	Quetta	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Chamba	4	1	1	1	1	1	...	1	1	1	1	2	...	1	...	...	1	1	...	...	...	Original furniture.

Return of the Instruments issued to each Observatory in 1883-84—contd.

Provinces.	Stations.	Barometers.	Hygrometers.		Dry maximum thermometers.	Minimum thermometers.		Radiation thermometers.		Anemometers.	Wind Vanes.	Rain-gauges.	Measure-glasses.	Lenses.	Clocks.	Sand-glasses.	Stands for sun thermometers.	Pads for grass radiation thermometers.	Cages.	Standard thermometers.	Compasses.	Sundials.	Remarks.
			Dry bulb.	Wet bulb.		Dry.	Wet.	Solar.	Grass.														
Cashmere.	Leh	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	12 thermometers for actinometers and three lenses have been sent to Mr. Hennessey at Mussooree for verification.
Punjab.	Kailang	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1	
	Lahore	...	...	...	...	...	...	2†	1†	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Mooltan	...	...	...	...	...	...	1‡	...	...	...	...	...	...	1	1†	...	...	...	...	...	...	
	Dera Ismail Khan	...	...	...	...	...	...	...	1‡	...	...	...	...	...	...	1†	...	...	...	...	...	...	
	Peshawar	...	...	...	...	...	...	1†	...	...	...	...	...	...	...	1*	...	...	...	...	...	...	* New Instruments.
	Rawalpindi	...	...	...	...	...	...	...	1*	...	...	...	...	...	1*	1*	...	...	...	...	...	...	
	Murree	...	...	...	...	...	...	...	3‡	1†	1‡	...	...	...	...	1*	...	...	...	...	...	...	† Substituted for old ones.
	Sealkot	...	...	...	...	...	1†	...	1†	...	...	...	...	...	...	1†	...	...	...	...	...	...	‡ Substituted for broken ones.
	Ludhiana	...	...	...	1†	...	1‡	...	...	...	...	..	...	...	...	1†	...	...	...	...	...	...	
	Sirsa	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1†	...	...	...	...	...	...	
	Delhi	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1†	...	...	...	...	..	...	
	Simla	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
N.-W. P. and Oudh.	Allahabad — Muir College	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Allahabad — New observatory	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3§	...	...	§ For ground observations.
	Meerut	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Agra	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	
	Roorkee	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Mussooree	...	...	...	1	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	..	...	
	Lucknow	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1	...	...	...	...	...	
	Ranikhet	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Bareilly	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	.	...	...	...	
	Chakrata	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Benares	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Gorakhpur	...	...	...	...	...	..	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	
	Jhansi	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	
Assam.	Sibsagar	...	...	...	1	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	
	Dhubri	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Silchar	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1	...	...	...	...	...	...	
Bengal.	Purneah	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Burdwan	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	
	Darjeeling (St. Paul's School)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Durbhanga	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Patna	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Gya	1‖	...	1‖	...	...	1‖	...	...	1‖	...	...	...	...	...	1	...	...	...	...	...	...	‖ To replace defective instruments.

Return of the Instruments issued to each Observatory in 1883-84—contd.

Province.	Stations.	Barometers.	Hygrometers.		Dry maximum thermometers.	Minimum Thermometers.		Radiation thermometers.		Anemometers.	Wind Vanes.	Raingauges.	Measure-glasses.	Lenses.	Clocks.	Sand-glasses.	Stands for sun thermometers.	Pads for grass radiation thermometers.	Cages.	Standard thermometers.	Compasses.	Sundials.	Remarks.
			Dry bulb.	Wet bulb.		Dry.	Wet.	Solar.	Grass.														
Bengal—*contd.*	Hazaribagh	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	
	Jessore	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	1	...	...	...	...	
	False Point	1	...	...	...	...	...	...	...	1*	...	...	...	...	...	1	...	...	...	...	...	...	
	Chittagong	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Saugor Island	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	
	Gopalpore	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	
	Balasore	1	1	1	1	1	...	...	...	1*	1	1	1	...	...	...	...	...	...	...	...	...	
	Midnapore	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...	...	...	...	...	..	...	
	Raneegunge	1	1	1	1	1	...	...	...	1	1	1	1	...	1	...	...	...	...	...	...	...	
	Noakhally	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	* To replace defective instruments.
	Burrisaul	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	
	Serajgunge	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	
	Commillah	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	
	Furreedpore	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	
	Mymensing	1	3	2	1	1	...	...	...	1	1	1	1	...	...	...	...	...	...	...	..	...	
	Rampore Beauleah	1	1	1	1	1	...	...	...	1	1	1	1	1	...	...	...	...	...	...	...	...	
	Dinagepore	1	1	1	1	1	...	...	...	1	1	1	1	1	1	...	...	...	...	...	...	...	
	Rungpore	1	1	1	1	2†	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	† One out of order in transit.
	Julpigoree	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	
	Bhágulpore	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	
	Chupra	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	
	Motihari	2	1	1	2	1	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	
	Buxar	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	
	Arrah	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	
	Dehree	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	
	Nya Doomka	1	1	1	1	1	...	...	...	1	1	1	1	...	...	..	...	...	...	...	...	...	
	Ranchee	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	
	Chyebassa	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	
Central Provinces.	Nagpur	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Jubbulpore	3	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Pachmarhi	...	...	...	...	...	...	...	3	...	...	...	1	...	...	...	...	...	...	...	...	...	
	Saugor	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Hoshangabad	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	..	...	
	Khandwa	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Seoni	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Raipur	1	...	1	...	...	1	...	...	1	...	...	...	...	...	1	...	...	...	...	...	...	
	Sambalpore	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Chanda	...	...	...	...	...	...	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	

Return of the Instruments issued to each Observatory in 1883-84—contd.

Province.	STATIONS.	Barometers.	HYGROMETERS.		Dry maximum thermometers.	MINIMUM THERMOMETERS.		RADIATION THERMOMETERS.		Anemometers.	Wind Vanes.	Raingauges.	Measure-glasses.	Lenses.	Clocks.	Sand-glasses.	Stands for sun thermometers.	Pads for grass radiation thermometers.	Cages.	Standard thermometers.	Compasses.	Sundials	REMARKS.
			Dry bulb.	Wet bulb.		Dry.	Wet.	Solar.	Grass.														
BERAR.	Chikalda	...	...	...	...	...	...	...	...	...	...	...	...	...	1*	...	...	...	...	...	...	...	* In lieu of one out order.
	Akola	...	...	...	...	...	...	1*	...	...	...	...	...	1	1*	...	...	...	...	...	...	...	
	Amraoti	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	1*	...	...	...	...	
CENTRAL INDIA.	Indore	...	...	...	...	...	...	...	...	...	...	...	...	...	1*	...	...	...	...	...	...	...	
RAJPUTANA.	Bickaneer	...	...	...	1*	...	...	...	1†	...	...	...	...	...	...	...	...	...	...	...	...	...	† In lieu of one broken.
	Sambhar	..	...	2	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Ajmere	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Pachbudra	...	...	...	...	...	...	...	2	1	...	...	...	...	2‡	...	...	...	...	...	...	...	‡ One watch and one clock.
BOMBAY.	Jacobabad	...	...	...	1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Hyderabad	...	...	...	1*	...	...	...	1†	1*	...	...	...	...	...	...	...	...	...	...	...	...	
	Kurrachee	...	...	...	...	...	...	...	1†	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Bhuj	...	...	...	...	1†	...	...	...	1*	...	...	...	...	...	...	...	...	...	...	...	...	
	Deesa	...	...	...	...	...	...	...	1†	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Rajkot	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	
	Malegaon	...	...	...	...	...	...	...	1†	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Poona	...	...	...	...	...	...	...	1†	...	...	...	1†	...	...	...	...	...	...	...	...	...	
	Sholapur (old obsy.)	...	...	...	...	...	...	...	1†	...	...	...	...	...	...	1§	...	...	...	...	...	...	§ In lieu of one stolen.
	,, (new ,,)	1	1	1	1	1	1	1	1	1	...	1	1	...	...	...	1	2	...	...	1	...	
	Belgaum	...	...	...	...	...	1†	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Ratnagiri	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1*	...	...	...	...	
	Karwar	...	...	...	...	...	...	...	...	...	...	...	...	...	2*	...	...	...	...	...	...	...	
	Baroda	1	1	1	1	1	1	1	1	1	...	1	1	...	...	1	1	2	...	...	1	...	
MADRAS, MYSORE, AND COORG.	Bellary	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Trichinopoly	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1	...	...	...	...	...	...	
	Masulipatam	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Madura	...	1	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Salem	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Coimbatore	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Wellington	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Negapatam	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Bangalore	..	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Kurnool	...	...	...	...	...	1	1	1	...	...	...	...	...	...	1	...	...	...	...	...	..	
	Cuddapah	1	1	1	1	1	1	1	1	...	1	1	1	...	...	...	1	1	...	...	...	...	
	Rajamundry	1	...	...	...	...	...	1	1	...	...	...	...	...	...	...	1	1	...	...	...	...	
	Secunderabad	...	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Mercara	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Amini Divi	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	

Return of the Instruments issued to each Observatory in 1883-84—concld.

Province.	Stations.	Barometers.	Hygrometers.		Dry maximum thermometers	Minimum thermometers.		Radiation thermometers.		Anemometers.	Wind Vanes.	Raingauges.	Measure-glasses.	Lenses.	Clocks.	Sand-glasses.	Stands for sun thermometers.	Pads for glass radiation thermometers.	Cages.	Standard thermometers.	Compasses.	Sundials.	Remarks.
			Dry bulb.	Wet bulb.		Dry.	Wet.	Solar.	Grass.														
BURMA.	Rangoon	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	
	Thyetmio	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Bassein	...	...	...	1*	1*	1*	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	* Replacing those stolen from observatory.
	Tounghoo	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1	...	...	...	...	...	...	
	Moulmein	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1	...	...	...	...	...	...	
	Mergui	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	
BAY ISLANDS.	Port Blair	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Nancowry	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	† Frankland's sun thermometer.
	Alipore	...	...	...	1	1	...	1†	...	1‡	...	...	...	...	...	...	...	1	...	...	...	...	‡ Beckley's self-registering anemometer.
	F. L. V. *Planet*	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Dehra (Forest School)	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Ajmere (Forest Dept.)	...	2	2	2	2	2	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	
	Makhla	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Mominabad	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	
	Erinpura	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	
	Lohardugga	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	
	Cuttack (Tributary Mehals)	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	

APPENDIX L.

List of Recipients of the Publications of the Meteorological Office.

Adelaide	Meteorological Observatory.
Agra	The Editor of the *Delhi Gazette.*
Ajmere	Chief Commissioner of Ajmere.
Akola	Sanitary Commissioner for Berar.
Algeria	Director of the Meteorological Service of the Ecole des Sciences d'Alger.
Allahabad	Secretary to the Government, North-Western Provinces and Oudh.
	Department of Revenue and Agriculture, North-Western Provinces and Oudh.
	Meteorological Reporter, North-Western Provinces and Oudh.
	Sanitary Commissioner, ditto ditto.
	Editor of the *Pioneer.*
	The Accountant-General, North-Western Provinces and Oudh.
Amsterdam	Royal Academy of Sciences.
Bangalore	Chief Commissioner, Mysore and Coorg.
	Conservator of Forests, Mysore and Coorg.
Batavia, Java	Meteorological Observatory.
Berlin	Ditto Institute.
Bombay	Secretary to the Government of Bombay.
	Meteorological Reporter for Western India.
	Colaba Observatory.

Bombay—*contd.*	Sanitary Commissioner with the Government of Bombay.
	Bombay University.
	Asiatic Society of Bombay.
	Sassoon Mechanic's Institute.
	Geographical Society of Bombay.
	Editor of the *Bombay Gazette.*
	Ditto *Times of India.*
	Elphinstone College.
Brisbane, Queensland	Observatory.
Brussels	Royal Academy of Sciences.
	Observatoire Royal.
Budapesth	Observatory.
Calcutta	Secretary of State for India (through Revenue and Agricultural Department).
	Secretary to the Government of India, Revenue and Agricultural Department.
	Ditto ditto Home Department.
	Ditto ditto Public Works Department.
	Ditto ditto Foreign Department.
	Ditto ditto Department of Finance and Commerce.
	Ditto ditto Military Department.
	Private Secretary to His Excellency the Viceroy.
	Secretary to the Government of Bengal, Revenue Department.
	Meteorological Reporter to the Government of Bengal.
	Surveyor General of India.
	Superintendent, Geological Survey of India.
	Sanitary Commissioner with the Government of India.
	Ditto ditto ditto Bengal.
	Superintendent, Botanical Gardens, Calcutta.
	Inspector-General of Forests, with the Government of India.
	Surgeon-General ditto ditto.
	Asiatic Society of Bengal.
	Indian Museum Library.
	Calcutta University.
	Presidency College.
	Public Library.
	Editor of the *Calcutta Review.*
	Ditto *Statesman and Friend of India.*
	Ditto *Englishman.*
	Ditto *Indian Daily News.*
	Ditto *Hindu Patriot.*
	Ditto *Indian Agriculturist.*
	St. Xavier's College Observatory.
	The Alipore Observatory.
	Mint Master.
	Indian Association for the Cultivation of Science.
Cambridge	University Library (through H.M.'s Secretary of State for India).
Cambridge, Massachusetts	Harvard University.
Cape of Good Hope	Astronomer Royal.
Carlsruhe, Baden, Germany	Bureau für Meteorologie und Hydrographie.
Chemnitz	Royal Meteorological Institute.
Chatham	Royal Engineer's Library (through Revenue and Agricultural Department).
Christiania	Norske Meteorologiske Institut.
	Royal Observatory.
Colombo	Editor of the *Ceylon Times.*
	Ditto *Ceylon Observer.*
	Surveyor General of Ceylon.

List of Recipients of the Publications of the Meteorological Office—continued.

Constantinople	Observatoire Impérial Météorologique.
Copenhagen	Danske Meteorologiske Institut. Royal Danish Academy of Sciences.
Cordoba	Meteorological Office.
Darjeeling	Conservator of Forests, Government of Bengal.
Dehra Dun	Editor of the *Indian Forester.* Superintendent, Great Trigonometrical Survey.
Dharwar	Conservator of Forests, Bombay, Southern Division.
Dublin	Royal Dublin Society.
Dacca	Dacca College.
Edinburgh	Scottish Meteorological Society. Astronomer Royal for Scotland, Royal Observatory.
Ellichpore	Assistant Conservator of Forests, Melghat Division.
Goa	Royal Observatory.
Greenwich	Astronomer Royal, Royal Observatory.
Guatemala	Observatorio Meteorologico del Institut Nacional de Guatemala.
Hamburgh	Nord Deutsche Seewarte.
Havana	Real Collegio de Belen.
Hong-Kong	Observatory.
Indore	Agent to the Governor General for Central India in charge of the Residency.
Iowa, U. S.	Iowa Weather Service.
Jeypore	Maharajah's Observatory.
Jubbulpore	Civil Surgeon of Jubbulpore.
Katmandu	Resident at Nepal.
Khandwa	Civil Surgeon of Nimar.
Kitzingen, Bavaria	Dr. Emil Von Schlagintweit.
Kurrachee	Conservator of Forests, Bombay, Sind Division.
Lahore	Secretary to the Government of the Punjab. Meteorological Reporter ditto ditto. Sanitary Commissioner ditto ditto. Conservator of Forests ditto ditto. Editor of the *Indian Public Opinion.*
Lisbon	Observatoire de Infante d'Luiz. Academy of Sciences.
London	Meteorological Council. Royal Society. Royal Asiatic Society (through H.M's Secretary of State for India). Society of Arts. Institution of Civil Engineers. Royal School of Mines. Royal Meteorological Society. Admiralty Library. United Service Museum. British Museum (through H. M.'s Secretary of State for India). Editor of the *Philosophical Magazine.* Ditto *Athenæum.* Ditto *Nature.* Ditto *Symon's Monthly Meteorological Magazine.* Ditto *Westminster Review.* Ditto *Quarterly Review.*
Madras	Secretary to the Government of Madras. Ditto ditto Public Works Department. Meteorological Reporter to the Government of Madras. Government Astronomer, Madras. Sanitary Commissioner, Government of Madras.

Madras	Madras University.
	Editor of the *Madras Times.*
	Ditto *Madras Athenæum.*
	Ditto *Madras Mail.*
	Superintendent, Government Central Museum.
	The Agricultural Reporter, Government of Madras, Saidapet.
	Surgeon General, British Medical Department.
	Ditto Indian Medical Department.
	Master Attendant of Madras.
	Conservator of Forests, Northern Circle.
Madrid	Royal Observatory.
Magdeburgh	Principal of the Observatory of the Magdeburgh Zeitung.
Manchester	Literary and Philosophical Society.
Manila	Meteorological Observatory.
Mauritius	Meteorological Society.
Melbourne, Victoria	The Observatory.
	University Library.
	Public Library.
Mexico	Central Meteorological Observatory.
Milan	Royal Astromonical Observatory.
Munich	Royal Observatory.
	Royal Bavarian Academy of Sciences.
	Geographical Society.
	The Publishers of the *Deutsche Rundschau für Geographie und Statistik.*
Nagpur	Chief Commissioner, Central Provinces.
	Sanitary Commissioner Ditto.
	Inspector General of Education, Central Provinces.
	Superintendent, Meteorological Observatory.
	Conservator of Forests, Central Provinces.
Naini Tal	Ditto ditto North-Western Provinces and Oudh.
New Haven, Connecticut	Connecticut Academy of Arts and Sciences.
	Editors of the *American Journal of Science.*
New York, U. S.	Central Park Observatory.
Nowgong-Rajshahye	Sub-Divisional Officer.
Ootacamund	Conservator of Forests, Government of Madras.
	Editor of the *South of India Observer.*
Oxford	Radcliffe Library.
	Radcliffe Observatory.
Paris	Observatoire Physique Central de Montsouris.
	Editor of *La Nature.*
	Physical Observatory, Meudon.
	Bureau Central Météorologique.
	Meteorological Society of France.
Perpignan, France	Commission Métérol. des Pyrénées Orientales.
Perth, W. Australia	Surveyor General.
Pesaro, Italy	Royal Observatory.
Philadelphia	Franklin Institute.
Poona	Conservator of Forests, Bombay, Northern Division.
Prag, Bohemia	Observatory.
Raipur	Civil Surgeon of Raipur.
Rangoon	Chief Commissioner, British Burma.
	Sanitary Commissioner, ditto.
	Conservator of Forests, ditto.
	Editor of the *Rangoon Times.*
Rome	Meteorological Office (Ministryof Agriculture).

List of Recipients of the Publications of the Meteorological Office—concluded.

Rio de Janeiro	Imperial Observatory.
Shaharunpore	Superintendent, Botanic Gardens.
Secunderabad	Secretary to the Resident at Hyderabad.
Shillong	Chief Commissioner of Assam.
	Deputy Conservator of Forests, Assam.
Simla	Assistant Quarter-Master General, Intelligence Branch.
Singapore	Principal Civil Medical Officer, Straits Settlements.
Stockholm	Nautisk Meteorologiska Byran.
St. Petersburg	Observatoire Physique Central.
	Geographical Society of Russia.
Strasburg	Imperial University Library.
Stonyhurst	Stonyhurst College Observatory.
Sydney	Observatory.
	University Library.
Syracuse, Sicily	Royal Meteorological Observatory.
Tasmania	Royal Society.
Tiflis, Russia	Physical Observatory.
Tokei, Japan	Imperial Mining Office.
	Imperial Meteorological Observatory.
Toronto, Canada	Magnetical and Meteorological Observatory.
Turin	Royal Astronomical Observatory.
Upsala	Meteorological Observatory.
Utrecht	Royal Dutch Meteorological Institute.
Vienna	K. K. Central-Anstalt für Meteorologie und Erdmagnetismus
	K. K. Geologische Reichsanstalt.
	Imperial Academy of Sciences.
	Dr. J. Hann.
Vizagapatam	A. V. Nursingrow, Esquire.
Washington, U. S.	Chief Signal Officer, United States Army.
	Smithsonian Institution.
	Naval Observatory.
	Hydrographic Office.
	Professor Cleveland Abbe, Signal Office.
	United States' Geological Survey.
Wellington, New Zealand	Observatory.
Woolwich	Royal Artillery Library.
Zi-ka-wei, Shanghai	Magnetical and Meteorological Observatory.
Zurich	Central Meteorological Institute.

APPENDIX M.

Presentations to the Library from the 1st April 1883 to the 31st March 1884.

Place.	Donors.	Title of Work.
ADELAIDE	Meteorological Observatory	Meteorological observations made at the Adelaide Observatory during the year 1880.
ALGIERS	Meteorological Service	Bulletin Météorologique du Gouvernement général de l'Algerie; from 1st March 1883 to 16th January 1884.
		Résumé climatologique, June to September 1882.
		Tableau récapitulatif des quantités de pluie tombées quotidiennement; June to September 1882.
		Observations météorologiques du Réseau Africain, Année 1880; stations Algériennes.
ALLAHABAD	Meteorological Office	Administration Report of the Meteorological Reporter to the Government of the North-Western Provinces and Oudh for the year 1882-83.
		Sketch of the Meteorology of the year 1882 in the North-Western Provinces and Oudh and Eastern Rajputana.
AMSTERDAM	Royal Academy of Sciences	Processen Verbaal, 1881-82.
		Jaarboek, 1881.
		Verslagen en Mededeelingen. Afd Natuurkunde. Tweede Reeks, Deel XVII.
BATAVIA	Magnetical and Meteorological Observatory.	Rainfall in the East Indian Archipelago, 1882 (fourth year).
BERLIN	Royal Prussian Statistical Bureau	Der Südlichste Gletscher Europa's.
		Kurze Anleitung zur Anstellung der einfachster klimatologischen Beobachtungen.
		Klima des Brocken.
		Ueber den jährlichen Gang der Temperatur in Norddeutschland.
		Zur Leistungsfähigkeit des compensirten Magnetometers Weber Kohlrausch.
	Royal Meteorological Institute	Preussische Statistik LXXI: Ergebenisse der meteorologischen Beobachtungen im Jahre 1882.
BRUSSELS	Royal Academy of Sciences	Bulletins de l'académie Royal des sciences des lettres et des Beaux-arts de Belgique, 3me série, Tomes I to V.
		Annuaire 1882 et 1883.
BOMBAY	Government of Bombay	Bombay Gazetteer, Vols. VII, XI, XII (Parts I and II), XIV, XV (Parts I and II), and XVI.
		Nineteenth Annual Report of the Sanitary Commissioner to the Government of Bombay for 1882.
		Report on the Enteric Fever.
	Meteorological Office	Brief Sketch of the Meteorology of the Bombay Presidency in 1882.
CALCUTTA	Comptroller General	Civil Estimates for 1883-84.
		Civil Account Code, Volume I, 3rd edition.
	Geological Survey of India	Records of the Geological Survey of India, Volume XVI, Parts II, III, and IV, and Volume XVII, Part I.
		Memoirs of the Geological Survey of India, Volumes XII, XIX (Part IV) and XX (Parts I and II).
	Government of Bengal	Report on the external trade of Bengal with Nepal, Sikkim, and Bhutan, for the year 1882-83.
		Returns of the rail-borne traffic of Bengal, during the quarters ending 30th June and 30th September 1883.
		Report on the internal trade of Bengal for 1882-83.
	Government of India, Home Department.	Daily Bulletin of Synopses, Indications, and Facts for September to December 1877, issued by the Chief Signal Office, Washington.

Place.	Donors.	Title of Work.
CALCUTTA—*contd.*	Government of India, Home Department—*contd.*	Rain and dry winds computed for different geographical districts, corrected to 1st January 1880 and 1st January 1881; issued by the Chief Signal Office, Washington.
		Suggestions as to the practical uses of meteorological reports and weather, maps; issued by the Chief Signal Office, Washington.
		Instructions for the management of self-recording meteorological instruments at the office of the Chief Signal Office, United States, America; issued by the Chief Signal Office, Washington.
		Instructions for taking and recording meteorological observations and for preserving and repairing instruments; issued by the Chief Signal Office, Washington.
		The influence of forests upon rainfall and inundations, being an extract from a work entitled "Etudes sur les Inondations," issued by the Chief Signal Office, Washington.
		Chronometer rates as affected by change of temperature and other causes; issued by the Chief Signal Office, Washington.
		Instructions concerning meteorological observations; issued by the Chief Signal Office, Washington.
		List of publications and maps relating to Forest Administration in India, sent to the Edinburgh International Forestry Exhibition of 1884.
	Government of India, Revenue and Agricultural Department.	Codes of the Financial Department, sixth edition, 1884.
		Statistics of the British-born subjects recorded at the Census of India, 17th February 1881.
		Statistics of the population enumerated in the Andamans, 17th February 1881.
		Report on measurements of the growth of Australian trees on the Nilgiris.
		Report of the Census of the Punjab taken on the 17th February 1881, Vols. I to III.
		Report of the Census of Assam for 1881.
		Note on Census operations in Central India and statements showing population, &c., 1882.
		Census of North-Western Provinces and Oudh in 1881, sex statistics.
		Census of the Central Provinces, 1881, Vols. I and II.
		Operations and results of the Census of 1881 in the Presidency of Bombay, including Sind.
		Report of the Census of the Baroda Territories 1881.
		Tables to accompany the rainfall map of the North-Western Provinces and Oudh, 1883.
		Administration Report upon the Madras Observatory for 1882.
		Operations and results of the Imperial Census of 1881 in the Presidency of Madras, Vols. I to V.
		Report of the Census of Bengal, 1881, Vols. I to III.
		The Indian Empire Census of 1881, statistics of population, Vol. II.
		Report on the condition and proceedings of the Government Observatory, Culaba, for the year which ended with the 30th June 1883.
	Inspector General of Forests with the Government of India.	Suggestions regarding Forest Administration in the Hyderabad Assigned Districts.
		Suggestions regarding Forest Administration in the Central Provinces.
		Review of the Forest Administration in the several Provinces under the Government of India, for the year 1881-82.
	Sanitary Commissioner with the Government of India.	Nineteenth Annual Report of the Sanitary Commissioner with the Government of India for 1882.
	S. R. Elson, Esquire . . .	The Sandheads Sailing Directory.
	St. Xavier's College Observatory	Meteorological observations recorded at the St. Xavier's College Observatory from January to December 1883.

Presentations to the Library from the 1st April 1883 to the 31st March 1884—continued.

Place.	Donors.	Title of Work.
Calcutta—*contd.*	Surveyor General of India	General Report on the operations of the Survey of India during 1881-82.
Cape of Good Hope	Meteorological Commission	Report of the Meteorological Commission for the year 1882.
Capodimonte	A. Nobile	Terza determinazione della latitudine geographica del R. osservatorio di Capodimonte.
Chemnitz	Royal Meteorological Institute	Jahrbuch des Köngl Sachs Meteorologischen Instituts, 1883. Erste Lieferung.
Christiania	Professor Mohn	The Norwegian North Atlantic Expedition, 1876-1878 (Meteorology).
	Royal University of Norway	Jahrbuch des Norwegischen meteorologischen Instituts 1877 to 1880. Etudes sur les mouvements de l'atmosphère, deuxiéme partie.
Colombo	Surveyor General of Ceylon	The Meteorology of Ceylon in 1881.
Copenhagen	Institut Météorologique Danois	Bulletin Météorologique du Nord, February 1883 to January 1884.
		Annuaire Météorologique pour l'année 1881.
	Royal Danish Academy of Sciences	Oversigt, No. 3 of 1882 and Nos. 1 and 2 of 1883.
Cordoba	Meteorological Office	Annales de la oficina meteorologica Argentina, Tomo III.
Dehra Dun	The Editors	The Indian Forester, Volume X, Nos. 1 to 3.
	Trigonometrical Survey of India	Synopsis of the results of the operations of the Great Trigonometrical Survey of India, Vols. XIV to XVI.
		Account of the operations of the Great Trigonometrical Survey of India, Vols. I and IX.
Greenwich	Royal Observatory	Greenwich magnetical and meteorological observations, 1881.
Guilford (Surrey).	A. H. Swinton, Esq.	Data obtained from solar physics and earthquake commotions applied to elucidate locust multiplication and migration.
Hamburgh	Deutsche Seewarte	Monatliche Uebersicht der Witterung, September 1882 to August 1883 and year 1882.
		Wetterbericht, Nos. 32 to 365 of 1883 and Nos. 1 to 60 of 1884.
Hongkong	Government of Hongkong	Meteorological observations recorded at Hongkong from February to December 1883.
		Meteorological observations recorded at stations in the colony of Hongkong for 1st to 14th December 1883.
Iowa	Weather Service	First and Second Annual Reports for 1876 and 1877.
Karlsruhe	Baden Meteorological Observatory.	XIV Jahresbericht der Grossherz-Badischen meteorologischen Centralstation Karlsruhe für das Jahre, 1882.
Kew	G. M. Whipple, Esq., B.Sc.	Composite portraiture adapted to the reduction of meteorological and other similar observations.
	Kew Committee of the Royal Society.	Report of the Kew Committee for the year ending 31st October 1883.
London	Balfour Stewart, Esq.	Terrestrial Magnetism.
	G. J. Symons, Esq.	Symons's Monthly Meteorological Magazine, March 1883 to February 1884.
	Hon'ble Ralph Abercrombie, F.M.S., and William Marriott, F.M.S.	Popular Weather Prognostics.
	Institution of Civil Engineers	The Introduction of Irrigation into new countries as illustrated in North-Eastern Colorado.........O'Meara.
		Discharge of streams in relation to rainfall in New South Wales.
	Meteorological Society	Quarterly Journal, Vol. IX, Nos. 45 to 48.
		The Meteorological Record, Nos. 8 to 10.
		Instructions for the observation of phenological phenomena.
	Meteorological Office	Weekly weather report, Vol. VI, Nos. 9 to 52.
		Report of the Meteorological Council to the Royal Society for the year ending 31st March 1882.
		Weather Reports, 1st January to 30th June 1882; 1st July to 31st December 1882; 1st January to 30th June 1883.

Presentations to the Library from the 1st April 1883 to the 31st March 1884—continued.

Place.	Donors.	Title of Work.
LONDON—*contd.*	Meteorological Office—*contd.*	The Quarterly weather report, Part II, April to June 1876, 1877, 1879, 1880, Appendices and Plates.
		Hourly readings from the self-recording instruments at the seven observatories, Parts I to IV, January to December 1881; Part I, January to March 1882.
		Rainfall tables of the British Isles for 1866 to 1880.
		Note on the Report on the Meteorology of Kerguelen Island, published by the Meteorological Council, 1879.
		Meteorologische Beobachtungen, angestellt auf Schiffen der Russischen Flotte, Band I.
		Meteorological Atlas of the British Isles.
		Sunshine records of the United Kingdom for 1881.
		Report of the second meeting of the International Meteorological Committee held at Copenhagen, August 1882.
	Royal Asiatic Society	Journal, Vol. XV, Parts I to IV.
	Royal Society	Proceedings Nos. 222 to 226.
	Society of Arts	Journal Nos. 1582 to 1633.
	Solar Physics Committee	Report by the Committee on Solar Physics.
	W. Clement Ley	Note on a proposed scheme for observation of the upper clouds.
MAGDEBURG	Meteorological Observatory	Jahrbuch der Meteorologischen Beobachtungen der Wetterwarte der Magdeburgischen Zeitung Station 1er Ordnung. Jahrg I (1881 und 1882).
MANCHESTER	Rev. F. W. Stow, M.A., F.M.S.	Comparative observations of solar radiation.
		Solar radiation. An account of some experiments made at Herpenden, Herts.
		Solar radiation, 1869 to 1874.
		Absorption of the sun's heat-rays by the vapour of the atmosphere.
MANILA	Observatorio Meteorologico del Ateneo Municipal de Manila	Observaciones verificadas, October to December 1879, and also for 1880, 1881, and 1882.
MELBOURNE	Government Observatory	Monthly record of results of observations in Meteorology, Terrestrial Magnetism, &c., taken at the Melbourne observatory from March 1882 to November 1883.
MEUDON (Paris)	Physical Observatory	Annuaire du Bureau des Longitudes, 1884.
MEXICO	Central Meteorological Observatory	Anales del ministerio de Fomento de la Mexicana, Tomo VII.
		Boletin del ministerio de Fomento, Tomo VIII, Nos. 8 to 156.
		Revista mensual climatologica, Tomo I, No. 15; Tomo II, Nos. 1 and 2.
		Anuario, Ano de 1884 (Ano IV).
MILAN	R. Osservatorio di Brera in Milano	Osservazioni meteorologische orarie ottenute da strumente registratori durante l'anno, 1881.
		Sui temporali osservati nell'Italio superiore durante l'anno, 1878.
MONTSOURIS (Paris)	Observatoire de Montsouris	Annuaire pour l'an 1883.
MUNICH	Geographical Society	Jahresberichte, 1875 to 1881.
	Ludwig Radlkofer	Ueber die Methoden in der botanischen Systematik, insbesondere die anatomische Methode.
	The Publishers	Deutsche Rundschau für Geographie und Statistik, V Jahrg Nos. 7-12, VI Jahrg Nos. 1-6.
	Royal Academy of Sciences	Sitzungsberichte der Mathematische Physikalischen Classe 1881, Heft IV; 1882, Hefte I to V; 1883, Hefte I and II.
		Gedächtnissrede auf Otto Hesse.
		Abhandlungen der mathematische, physikalischen Classe, Band XIV. Abth II, III.
	Royal Observatory	Meteorologische und Magnetische Beobachtungen, Jahrgänge, 1881, 1882.

Presentations to the Library from the 1st April 1883 to the 31st March 1884—continued.

Place.	Donors.	Title of Work.
MAURITIUS	Meteorological Society of Mauritius	Mauritius meteorological results for 1876.
MADRAS	Government of Madras	Manuals of the Salem district, Vols. I and II, and Kistna and Tanjore districts.
	Meteorological Office	Administration Report of the Meteorological Superintendent of the Government of Madras for 1882-83.
NAGPUR	Chief Commissioner, Central Provinces.	Report on the model farm in the Central Provinces for the year 1882-83.
		Report on the trade and resources of the Central Provinces for the year 1882-83.
NEW YORK	Meteorological Observatory	Abstract of registers from self-recording instruments, December 1882 to November 1883.
PARIS	Bureau Central Météorologique de France.	Bulletin International, Vol. XXVII, Nos. 61 to 365; Vol. XXVIII, Nos. 1 to 52.
		Annales du Bureau Central Météorologique de France, 1877; 1879, Tomes II and III; 1880, Tomes I and IV.
	Société Météorologique de France	Annuaire de la Société Météorologique de France, 1880, 4th Trimestre; 1881, 1st and 2nd Trimestre; 1882, January, February, and May to November; 1883, January to September.
PHILADELPHIA	Franklin Institute	Journal, March 1883 to February 1884.
PRAG	K. K. Sternwarte	Astronomische magnetische und meteorologische Beobachtungen im Jahre, 1882.
RIO DI JANEIRO	Imperial Observatory	Bulletin Astronomique et météorologique, January to October 1883.
		Annales de l'observatoire Impérial de Rio de Janeiro, Tome I: description de l'observatoire.
SINGAPORE	Principal Civil Medical Officer, Straits Settlements.	Annual Medical Report on the Civil Hospitals in the Straits Settlements for the year 1882.
		Straits Settlements meteorological returns for 1882.
STONYHURST	Stonyhurst College Observatory	Results of meteorological and magnetical observations, 1860, 1862, 1865 to 1870, and 1872 to 1882.
STOCKHOLM	Avee Panchee	Sur la variation diurne de la force du vent par H. E. Hamburgh.
ST. PETERSBURG	International Polar Commission	Communications from the International Polar Commission, Part IV.
	Physical Central Observatory	Annalen des physicalischen Central Observatoriums, Jahrg. 1881, Theil II.
SYDNEY	Government Observatory	Results of rain and river observations made in New South Wales during 1882.
		Results of meteorological observations made in New South Wales during 1875.
		The Sydney Observatory, its history and progress.
		Anniversary address delivered to the Royal Society of New South Wales on the 3rd May 1882, by H. C. Russell, B.A., F.R.A.S.,&c.
		The spectrum and appearance of the recent comet, H. C. Russell.
SYRACUSE	Osservatorio Centrale di Siracusa	Osservazioni meteorologichi, Anno VII, Nos. 1 to 12.
TASMANIA	Royal Society	Papers and proceedings of the Royal Society of Tasmania for 1882.
TIFLIS	Physical Observatory	Magnetische Beobachtungen des Tiflischer physicalischen Observatoriums im Jahre 1882.
TOKIO	Imperial Meteorological Observatory.	Meteorological observations recorded at Ozaka, Hiroshima, Nügata, and Nagasaki for July to December 1882; at Kochi, April, and August to December 1882; at Kanazawa, March, April, and September to December 1882; at Tokio, June to October 1882.
	University of Tokio	Measurement of the force of gravity at Sappro (Yesso), being an Appendix to Memoir No. 5 of the Science Department.
TORONTO	Meteorological Office, Canada	Report of the Meteorological Service of the dominion of Canada for 1881.
		Monthly Weather Review, February 1883 to January 1884.
		General Meteorological Register for the year 1883.
TURIN	R. Osservatorio Astronomico di Torino.	Bolletino dell'osservatorio della regia Universita di Torino (Parte meteorologica) Anno XVII (1882).

Presentations to the Library from the 1st April 1883 to the 31st March 1884—continued.

Place.	Donors.	Title of Work.
UPSALA	Meteorological Observatory	Bulletin Mensuel, Vol. XIV, Année 1882.
		Sur la trombe du 7 Juin 1882 dans la vallée de Säby.
		Samlung of bemårkelsedagar tecken, marken, ordsprak och Strock ror ande vaderleken.
		Sur la distribution des Eléments météorologiques autour des minima et des maxima barométriques.
	Mons. A. G. Hogbom	Marche des isothermes en automne dans de Nord d'Europe.
VIENNA	Dr. J. Hann	Zeitschrift der oesterr. Meteor. Gesellschaft Band XVIII, April to December 1883; Band XIX, January to March 1884; Index for 1883.
		Bericht über die Fortschritte der geographischen Meteorologie.
	Dr. Josef M. Pernter	Psychrometerstudie.
	K. K. Central Anstalt für Meteorologie und Erdmagnetismus.	Jahrbüch, neue Folge, XVI Band, Jahrg 1879; XVII Band, Jahrg 1880; XVIII Band, Jahrg 1881. Erster Theil.
		Telegraphischer Wetterbericht, Jahrg VII, Nos. 60-355, and VIII, Nos. 1 to 41.
	K. K. Geologische Reichsanstalt	Verhandlungen No. 5 of 1881; Nos. 12 to 18 of 1882; Nos. 1 to 9 of 1883.
	Royal Academy of Sciences	*Ginzel.*—Astronomische Untersuchungen über Finsternisse.
		Freih v. Haerdtt.—Bahnbestimmung des Planeten "Adria."
		Hammerl.—Über Regenbogen, gebildet durch Flüssigkeiten von verschiedenen Brechungsexponenten. Studie über das Kupfervoltameter.
		Happerger.—Bahnbestimmung des Kometen 1874, III (Coggia).
		Holetschek.—Uber die Bahn des Planeten 111 Até II Theil.
		Gruss und Kogler.—Über die Bahn der Oenone 215.
		Tschermak.—Über die Meteoriten von Mocs.
		Tranz Wähner.—Das Erdbeben von Agram am 9th November 1880.
		Oppolzer.—Beitrag zur Ermittlung der Reduction auf den unendlichkleinen Schwingsbogen:
		Note über eine von Archilochos erwähnte Sonnenfinsterniss.
		Norbert Herz.—Zur Theorie der Bahnbestimmung eines Kometen:
		Über die Möglichkeit einer mehrfachen Bahnbestimmung ans drei geocentrischen Beobachtungen.
		Heinrich Krentz.—Über die Bahn des Kometen von 1771.
		Karl Telbr.—Über die Bahn der Kometarischen Nebelmasse Schmidt, 1882.
		Hobtschek.—Bahnbestimmung des vierten Kometen vom Jahre, 1874
		Stefan Wolyncewicz.—Bahnbestimmung des Planeten 210 " Isabella.
		Richard Canaval.—Das Erdbehen von Gmünd am 5 November 1881.
		Ferdinand Antow.—Bestimmung der Bahn des Planeten 114 Cassandra.
		Tulner Preston.—Eine dynamische Erklärung der Gravitation:
		Über die Möglichkeit, vergangene Wechsel im Universum durch die Wirkung der jetzt thätigen Naturgesetze auch in Übereinstimmung mit der Existenz eines Wärmegleichgewichtes in vergrössertem Masstabe zu erklären.
		Mach.—Versuche und Bemerkungen über das Blitzableitersystem das Herrn Melsenes.
		Pernter.—Psychrometerstudie.
		Schawarz.—Astronomische Untersuchung über eine von Archilochus und eine in einer assyrischen Inschrift erwähnte Sonnenfinsterniss.
		Leiznar.—Zur Theorie des Lamontschen Variations. Apparates für Horizontal Intensitat.
		Gerst.—Methode zur Bahnbestimmung aus drei vollständigen Beobachtungen.

Presentations to the Library from the 1st April 1883 to the 31st March 1884—concluded.

Place.	Donors.	Title of Work.
VIENNA—*contd.*	Royal Academy of Sciences	*Wolfbaner.*—Die chemische Zusammensetzung des Wassers der Donau von Wien im Jahre 1878.
		Foullon.—Über die mineralogische und chemische Zusammensetzung des am 16th February 1883. bei Alfianello gefallenen Meteorsteines.
		Tschermak.—Beitrag zur Classification der Meteoriten.
		Hann—Über die Klimatischen Verhältnisse von Bosnien und der Herzegownia.
		Neissl.—Bahnbestimmung des grossen Meteores vom 13, Marz 1883.
		Norbert Herz und Issef Strobel.—Reduction des Anwer'schen Fundamental. Cataloges auf die Leverrier'schen Praecessionscoefficienten.
		Ferdinand Antow.—Definitive Bahnbestimmung und Ephemeriden für den Planaten 154 Bertha.
		Anzeiger. Nos. XVII to XXVIII of 1882; Nos. I to XXI of 1883.
VIZAGAPATAM	A. V. Nursingrow, Esq.	Results of Meteorological observations made at G. V. Juggarow's Observatory, Vizagapatam, during 1881 and 1882.
WASHINGTON	Chief Signal Office	Bulletin of International Meteorological Observations, 1st September to 31st December 1880.
		Monthly Weather Review, December 1882 and January 1883.
		Annual Report of the Chief Signal Office for the year 1880.
		Bulletin of International Meteorology for August 1882.
	United States Geological Survey	A new method of measuring heights by means of the barometer, by G. K. Gilbert.
	United States Naval Observatory	Meteorological observations made at the United States Naval Observatory during 1878 and 1879.
WELLINGTON	Meteorological Observatory	Abstract of meteorological observations, New Zealand, for the quarters ending September and December 1882, and March, June, and September 1883.
		Statistics of New Zealand (meteorology), 1878 to 1882.
		Meteorological observations, Wellington, March and April 1883.
WINDSOR (N. S. WALES).	John Tebbutt, Esq.	Results of meteorological observations made at the private observatory of J. Tebbutt at Windsor (New South Wales) in 1877-81.
ZI-KA-WEI	Magnetical and Meteorological Observatory.	Meteorological observations recorded at Zi-ka-wei, October 1882 to June 1883.
		Variations de l'aiguille aimantée pendant les Eclipses de lune. Régime des vents à Zi-ka-wei, 1877 to 1882.
ZURICH	Swiss Meteorological Institute	Meteorologische Beobachtungen an 16 stationen der Sweiz, January to December 1883.

Purchases for the Library.

Airy's Algebraical and Numerical Theory of errors of observations and the combination of observations.
American Journal of Science, March 1883 to February 1884.
Annalen der Physik und Chemie, Nos. 4 to 12 of 1883; Nos. 1 to 3 of 1884.
Barlow's Tables of squares, cubes, square roots, cube roots, and reciprocals of all numbers up to 10,000.
Brown's mechanical movements.
Comptes Rendus de l'Académie des Sciences, Tome XC, No. 2; Tome XCVI, Nos. 10 to 26; Tome XCVII, Nos. 1 to 27; Tome XCVIII, Nos. 1 to 8; Tables for Tomes XCV and XCVI.
Die Geometrischen Instrumente der gesammten praktischen Geometrle, deren Theorie Beschreibung und Gebrauch.
Elementary Meteorology: Scott.
Encyclopædia Britannica, volumes X to XV.
La Nature, Nos. 467, 469, 494, 503 and 511 to 562.
Merriman's Method of Least Squares.
" Nature," Nos. 662, 681, 686, 687 and 698 to 749.
Philosophical Magazine for March 1883 to February 1884.
Report of the British Association for the advancement of science for 1878 and 1882.

Government of India Central Printing Office.—No. 17 Meteor.—20-9-84.—400.

REPORT
ON
THE ADMINISTRATION
OF THE
METEOROLOGICAL DEPARTMENT OF THE GOVERNMENT OF INDIA
IN
1885-86.

PART I.—GENERAL.

In accordance with the practice of recent years, I preface the report on the detailed administration of the department, with a notice of some of the more important subjects to which attention has been directed during the past year.

Actinometric Observations.—In the reports for three previous years, I have recounted the history of my endeavours to obtain more exact measures of the solar heat than had been practicable in the atmosphere of either Europe or India. With that object, Sergeant Rowland, who had been selected and sent out by the Secretary of State in 1882, after undergoing a thorough training at Dehra under the direction of Mr. J. B. N. Hennessey, was despatched to Leh in October 1883, together with a trained assistant. In last year's report, I had to relate how, owing to the adverse conditions of the climate, the results had fallen far short of our hopes and expectations, and I gave a tabular return of these results, amounting up to the end of March 1885, to 52 complete and 64 incomplete ordinary daily series of observations, and 6 complete and 14 incomplete long series.

The observers remained at Leh, continuing their work until the beginning of October 1885, and during the further interval of six months, obtained the following additions to their previous registers:—

Months.	Daily complete.	Series incomplete.	Long complete.	Series incomplete.
April 1885	...	2	...	...
May „	...	1	...	...
June „	3	5	...	1
July „	5	9	1	...
August „	...	9	...	...
September 1885	...	5	...	...
Total of six months	8	31	1	1
„ previous 17 months	52	64	6	14
„ whole period	60	95	7	15

The complete series of the final six months fell therefore considerably short even of the previous average, and it would obviously have been useless to prolong the experience. Sergeant Rowland and his assistant were therefore instructed to withdraw from Leh, at the end of the season, in time to ensure their reaching India before the closing of the passes. They left accordingly on the 3rd October and reported their arrival at Dehra on the 9th November, bringing back their instrumental equipment, which was then made over to the charge of Colonel Haig, Deputy Surveyor General in charge of the Dehra Office.

The instruments were in excellent order, and will be available for future work. Under the sanction of the Government, the services of Sergeant Rowland have been transferred to the Survey Department to carry on the work of solar photography, with the large heliographs provided for this purpose at Dehra. The assistant, Mr. H. Shaw, has been since employed carrying on the actinometric observations at Dehra and Mussooree, also under the direction of Colonel Haig. It is probable, judging from Mr. Hennessey's former experience, that, notwithstanding the lower elevation of this station and Mussooree, they will be found at least as well fitted for the work as Leh, while they offer far superior advantages in point of climate and accessibility.

The results of the 23 months' work at Leh have been sent home to the Solar Physics Committee for examination and discussion, copies being retained in this country. It may be hoped that, notwithstanding that they fall far short of what had been expected, they may still be found to yield information of much value. I have every reason to believe that they have been taken with the greatest care and attention to accuracy, in accordance with the elaborate system devised by Mr. Hennessey, and that all has been accomplished that could be accomplished by careful training, and assiduous devotion to the work on the part of the observers. Of their conduct during their two years' residence in Leh, I cannot give a better idea than to quote from the certificates forwarded by Sir Oliver St. John, Her Majesty's Resident in Kashmir, with the request that their excellent conduct may be brought to the notice of the Government of India. The Wazir of Ladak, Radha Kishen, writes to Sir O. St. John: "During two years of their stay here, for the greatest part of which their immediate superior, the British Joint Commissioner, was away, they always conducted themselves to my entire satisfaction . . . . They leave this country with my best wishes, and I hope that their good conduct and hard work in such a severe country as Ladak, where they have spent two winters continuously, will be the means of their advancement in their future employment." And Mr. Ney Elias, the British Joint Commissioner, observes: "I cannot leave this Agency without recording my good opinion of Sergeant Rowland . . . . For several months, during the absence of the Political Agent, he has carried on the current duties of the Agency Office. The way in which he has conducted himself throughout has been most creditable . . . . He has done his own duty, has got on well with the native officials and people of the country, and might be trusted to act with judgment and good sense in any independent position in a foreign country . . . . I hope his good services and admirable conduct will be duly recognised by the authorities at home."

SUNSHINE RECORDS.—During the past year, instruments for recording the duration of sunshine have been furnished to Lahore and Nagpur, making, with those already provided with them in previous years, five stations at which this important meteorological element is now the subject of regular registration. The other stations are Calcutta, Allahabad and Jeypore, where these records are now available for the following periods :—

Allahabad	since April 1882.
Calcutta	„ January 1883.
Jeypore	„ February 1884.

I offered in March last to supply an instrument to the Colaba Observatory, Bombay, but it has been declined by the Superintendent. It has therefore been sent to the Meteorological Reporter for Western India, whose office is situated at the Observatory, with instructions to obtain a regular register by its means.

GROUND TEMPERATURE.—A set of thermometers for registering the temperature of the ground, at the surface and at different depths of a few feet, (within the zone subject to an annual oscillation of temperature) has been furnished during the past year to Lahore. Observations of this kind have now been recorded under a similar arrangement for some years at Calcutta, Allahabad, Dehra and Jeypore, *viz.*:—

Calcutta (Alipore) . .	since April 1878.
Allahabad	„ May 1880.
Dehra	„ June 1881.
Jeypore	„ August 1881.
Lahore	„ August 1885.

These registers testify uniformly to the fact that, the ground is on an average from 3 to 5 degrees warmer than the air; the difference varying, however, with the time of year and also with the depth. It varies moreover, in some small degree, from year to year according, as would appear, to the relative prevalence of sunshine and rain. It appears that the ground acts as a store-house of solar heat, which penetrates to a depth the limits of which are not yet ascertained in India, and is gradually given out again to the superincumbent air. At Calcutta, the registers have established the important fact that, the temperature of the alluvial soil increases rapidly downwards, (at the rate of about 1° in 2 feet for the first few feet) indicating the existence of a permanent source of heat within a short distance of the surface. This source is probably to be found in a layer or layers of decomposing organic matter, sometimes reached in deep excavations for tanks, &c.

As the result of a long series of observations on the temperature of the rock of Calton Hill, Edinburgh, it has been thought probable that the variations of the ground temperature, from year to year, would serve as an indication of those of the solar heat. This, however, seems very doubtful. It is evident that the ground temperature is largely modified by rain and its subsequent evaporation, and it is unlikely that a much smaller temperature variation, arising from the assumed variability of the solar radiation, would be discoverable in the registers of any moderate period.

FIRST CLASS OBSERVATORIES.—There have been hitherto only three observatories in India, fully equipped with autographic instruments, for furnishing either a continuous register, or one repeated at short (ten minutes') intervals. These were the Government observatories at Calcutta (Alipore) and Bombay, and the Maharajah's observatory at Jeypore. During the past year, a fourth has been established at Allahabad, and a portion of the instruments for a fifth at Lahore, were received shortly after the close of the year, a suitable building having been already provided.

The new Allahabad Observatory is situated in the large open space known as the Chatham lines—a site admirably fitted for the purpose. The building has been erected for the accommodation of the observatory and the Meteorological Reporter's Office at an estimated cost of R13,000 and is therefore especially adapted to the proper exposure and working of the instruments. The autographic instruments consist of a Van Rysselberghe's meteorograph (the duplicate of that at Jeypore). It is worked by clock-work and electricity, and records at intervals of 10 minutes, the readings of the barometer, the wet and dry bulb thermometers, the duration of the wind, and also the distance travelled by the wind and the amount of rain that may have fallen in the previous ten minutes. All these are engraved on a zinc plate, graduated by the instrument while in the act of recording the reading, which, after removal from the instrument, is etched, and may then be printed from, and made to furnish any required number of copies of the register.

The instrument was set up and began to work in the beginning of March 1886. It will take some little time to accustom the observatory staff to the management of this new, somewhat complex and delicate instrument, and hitherto there have been occasional interruptions in its working. With increased experience and under Mr. Hill's guidance, it may be confidently expected that all difficulties will be eventually surmounted.

The similar meteorograph which was originally intended for the Lahore Observatory, having been disposed of to the Maharajah of Jeypore, it has not been thought desirable to obtain another for Lahore, where the difficulty of adjusting and managing it would have been much greater. And therefore a set of self-recording instruments will be supplied, which are simple in principle, independent in their action, and which register mechanically. Those for recording the atmospheric pressure, temperature and humidity, are the invention of Dr. Draper, and are similar to those which have long been in use in the New York Observatory. Those for rainfall and wind registration are the invention of Mr. Beckley and similar to those used at Kew and also at the Alipore Observatory in Calcutta. These latter are already in India.

The removal of the Lahore Observatory from the Mayo Hospital to a building nearly 4 miles distant, on the outskirts of Anarkalli, at the beginning of 1885, necessitated that observations should be recorded simultaneously at the old and new sites, sufficiently long to show what change in the apparent normal or average temperature, humidity, &c., of Lahore has been caused by the removal. These observations were carried on during 1885, and will be continued up to the end of 1886. There will then be two entire years' registers available for comparison, and these should suffice to show what corrections must be applied to the registers of past years to render them comparable with those of the present and future years.

RAINFALL STATISTICS.—Some further additions of importance have been made, during the past year, to the stations transmitting regular returns of the rainfall to the Central Office.

Most of these are due to the extension of rainfall registration in Rajputana, through the exertions of Dr. Hendley, Residency Surgeon at Jeypore; and some are of especial value, as representing the arid region of Western Rajputana, which, but a few years since, was an almost complete blank on the charts of recorded rainfall. The following are the newly-established stations:—

Bandikui.
Lalsot.
Siwai Madhopur.
Malpura.
Jhunjhnu.
Sri Madhopur.
Sikar.
Khetri.

Another important addition is that of Kelat in Beluchistan, and a third that of Pedong in Bhotan.

Including observatories, rainfall registers are now received from 484 stations in India and its dependencies, including Ceylon and other islands.

SNOWFALL REPORTS.—Reports of the snowfall on the mountains of the north-western and northern frontiers were received during the spring of 1885 from the following officers:—

The Deputy Commissioner of Bannu.
,, ,, ,, Dera Ismail Khan.
,, ,, ,, Kohat.
,, Political Agent, Khyber.
,, Assistant Commissioner of Eusufzye.
,, Deputy Commissioner of Peshawar.
,, ,, ,, Rawalpindi.
,, ,, ,, Kangra.

The Assistant Commissioner of Kulu.
,, Revd. A. W. Heyde, Kailang, Lahoul.
,, Collector of Kumaon.
,, Assistant Commissioner of Garhwal.
,, Civil Surgeon of Mussooree.
,, Deputy Commissioner of Darjeeling.
,, ,, ,, Kamrup.
,, ,, ,, Darang.

In many of the reports there was a considerable improvement on those of the preceding year, and those of the Deputy Commissioner of Kohat, the Assistant Commissioner of Kulu, and one or two others gave much useful information, collected from travellers and traders, as to the depth of snow on the passes and hills beyond the frontier. The Reverend A. W. Heyde's reports are also especially valuable as those of an intelligent observer, resident for many years in the inner Himalaya.

During the present cold weather and spring, reports have been received regularly from the same officers.

FORECAST OF THE MONSOON.—An attempt to estimate the prospects of the monsoon rains, based on the results of the snowfall reports and the general character of the winds and pressure distribution in the period immediately antecedent to the rainy season, has been made in each of the last two or three years. In 1885, the indications on which this forecast was based, were of a more pronounced character than in either of the previous years, and the prediction which they seemed to justify, *viz.*, that the influx of the monsoon rains, on the west coast and in Southern and Western India generally, would be retarded, was so amply borne out by the subsequent history of the season, that my confidence in the general validity of the method has been very much strengthened.

In a memorandum, dated 21st May, it was reported that "the snowfall on the Himalaya appears to have been universally heavy during the past season, and it has received continual additions up to the present time.;" that "the unusual weather of April and May had made large additions to the snows of the North-West Himalaya, preserving thick snow-beds down to 11,000 feet, even on the outermost hills, and mantling the higher ranges with an unbroken sheet of snow." From Kailang in Lahoul, the Reverend A. W. Heyde had written on the 4th May: "This is a very extraordinary spring, cold and exceedingly wet for Lahoul. On the northern slopes the fields are still covered with about 1½ feet of snow at this moment, which is altogether unusual for this part of Lahoul," &c. It was pointed out that the weather in the Punjab and, in a minor degree, all over Western India, had been unusually cool, and the barometer persistently high; that "owing to the coolness, the excess of pressure has been much greater on the plains than on the mountains; and greater in North-Western India, than to the east and south;" "more or less, the pressure has been above the average all over India, and although subject to marked oscillations, the average remains unusually high."

"Under such circumstances as these, west and north-west winds are always very prevalent in North-Western and Western India, and this has been the case during the present month (May). In some years they are most persistent in Northern India, blowing down the Gangetic plain and across Rajputana and Central India towards Bengal and Orissa. In other years they blow more steadily down the western side of the peninsula, in the Konkan and Western Deccan. The latter appears to be the case in the present year. . . . . Coming from a cool region, where there is little evaporation, these winds are always dry, and in proportion as they prevail, to the exclusion of the ordinary monsoon from equatorial seas, so is the season dry or wet . . . . Any condition that unduly raises the barometric pressure in North-Western India and on the Himalayas, and in Afghanistan and Beluchistan, favours the north-west winds. And since rain on the plains and unusual snow on the hills keep the air cool and heavy, they afford such a condition. But, if this depends on the extent of the Himalayan snows alone, it is not very lasting, although it may operate for some weeks."

Having thus traced out the grounds and principles on which the forecast was based, the conclusion was put forward in the following terms:—

"At present it would appear that the influx of the monsoon rains, on the west coast and in Southern and Western India generally, is likely to be retarded, and it is this branch of the monsoon that brings the greater part of the rainfall to the peninsula, Central and Western India. But in 1876, 1877 and the earlier part of 1878, the barometer was high over a large part of Asia, owing to some cause or causes as yet unknown; and this undoubtedly was one cause of the severe droughts of those years . . . . As far as our information goes, there is no reason for anticipating more than a retardation of the rains of the west coast."

"If the conditions remain as at present, there is no reason to anticipate any retardation of the monsoon on the Bengal side as well, but the only ground, at present, for forming a judgment on this point, is that there is a certain persistency in the weather phases of India; and that as the north-west winds seem at present to hold down the west of the peninsula, rather than across Northern India, there is a balance of probability in favour of their remaining so."

How far this forecast was realized, will best be shown by the following extracts from the monthly summaries of the weather, based on the telegraphic reports, and the preliminary report on the meteorology of the year, drawn up by Mr. Dallas, from the tabulated results of all the meteorological stations.

In the weather summary for June it is stated that the rainfall "has been distinguished by two noticeable characteristics: in the first place, the fall has been accompanied by a very unsteady monsoon current, while in the second place the extent of the fall has been greatly restricted. In Bombay itself, the burst of rain which usually characterizes the setting in of the monsoon on the Konkan coast has not occurred during the month, and the winds over that region appear to have been abnormally dry; and further to the southward, *i.e.*, on the Malabar coast, though the winds appear to have brought up the normal amount of moisture, it seems to have been deposited only on the western face of the Ghâts, and the stations on the Deccan and Hyderabad show a great deficiency of rainfall. The weather in the Berars, Khandesh and Guzerat has been similar to that prevailing in the Konkan, the winds having been unusually dry."

In Bengal[1] "on the 16th, a small depression was formed over the Sunderbuns; and as this little disturbance travelled, first westward and subsequently north-westward, the rains extended up the Gangetic plain, and by the 24th has set in over the greater part of the North-West Provinces. On the 26th, a second depression was formed over the Sunderbuns, and this disturbance travelling westward in its turn, fairly established the rains over the North-Western Provinces and as far west as Delhi and the east of the Punjab."

In the report for July it is stated "heavy rain fell at Mangalore on the 1st. This proved to be the beginning of a burst of rather heavy rain on the west coast, lasting until the 9th and spreading northward as far as Ratnagiri, without however reaching Bombay." . . . On the 17th, a fall of six inches occurred at Bombay, and larger amounts on the neighbouring hills. This was the first downpour of the season on the Konkan coast, and resulted in extensive floods in the neighbourhood of Bombay . . . . In the eastern and central parts of the peninsula, the normal westerly winds appear to have been exceptionally dry; and Mysore, Bellary and the Carnatic had even less than the small average rainfall. Further north, in the Northern Circars, Orissa, Chutia Nagpur and Lower Bengal, there has been a slight deficiency; but in Assam, Cachar, Northern Bengal and over the whole of the North-Western Provinces and Oudh, the rainfall has been excessive . . . . The figures for the season, up to date, show that the rains have been unfavourable in two regions—one includes the Konkan, Khandesh, and the Bombay Deccan, where the amount of rainfall for the two months, June and July, has been only from $\frac{1}{5}$ to $\frac{1}{2}$ the average amount, and the other the Punjab. In all other parts of the country the seasonal average has been fairly well maintained.

In August "during the first ten days the rainfall on the west coast was insignificant; but on the 12th it became heavier, . . . and during the week following, heavy showers fell at the majority of the peninsular stations." In the region under the influence of the Bengal branch of the monsoon, the weather was practically the same as in the preceding month.

From these reports, the general tenor of which is fully borne out by the more abundant data since received, it appears that the terms of the forecast made on the 21st May were very amply justified by the results.

TRUE CHARACTER OF THE MONSOONS.—Any successful attempt to forecast the prospects of the monsoon, or even to give a rational explanation of the variations which it has manifested, must be based on a true conception of its normal characters and its real nature. The description of the summer monsoon, which appears in most treatises on the subject, and which therefore represents the ideas most prevalent among well-informed persons, may be summarized somewhat as follows:—

The summer monsoon is regarded as an anomalous diversion of the south-east trade wind of the South Indian Ocean. Owing to the high temperature developed in the continent of Asia in the early summer months, and the consequent lowering of the atmospheric pressure, instead of a trade wind setting from the northern tropic towards the equator, as is the case in the Atlantic and Pacific Oceans, the south-eastern trade of the South Indian Ocean is prolonged across the equator and drawn onwards to Southern Asia as the south-west monsoon. This wind is saturated with vapour taken up from the expanse of sea over which it has passed, and the vapour is discharged as rain on India, the Malay Peninsula and China, in the rainfall of the summer monsoon.

---

[1] The average date for the setting in of the rains in Bengal is the 15th June. At Bombay it is usually estimated a few days earlier.

This view, while true as a first rough sketch of the facts, is in a certain measure erroneous; firstly, as an over-statement of fact, and secondly, regarded from another point of view, it is defective, inasmuch as it leaves unexplained the existence of a rainless or almost rainless region in Western India, and on the coast of Beluchistan; and also it affords no means of accounting for such vicissitudes of the monsoon rainfall as characterized the past year, and in a far more intense degree the year 1876.

In the first place, it is an over-statement of fact. The wind charts of the North Indian Ocean, now in course of preparation, show that the south-east trade, does not, as a rule, blow across the equator, and, changing its course from south-east to south and finally to south-west, pass gradually into a south-west monsoon. That it does occasionally do so is unquestionable, but such is rather the exception than the rule. A rainy belt in the neighbourhood of the equator exists throughout the year, which is fed by the south-east trades. In this belt, the winds are very variable, blowing from all quarters, from west-north-west round to south; and it is only some 6° to the north of the equator that the monsoon is established as a comparatively steady current of wind. The monsoon therefore, (in so far as it is a *south-west* monsoon,) is drawn from a reservoir of air over the equatorial zone, fed by the south-east trades, but it is not the south-east trade wind simply diverted from its former course. And the distinction is an important one.

Moreover, the Indian summer monsoon is not simply a *south-west* monsoon; and herein the prevalent view is defective in an important particular. On the Arabian Sea, and especially beyond the tropic, the winds are as frequently west as south-west and not infrequently north-west, and this is also the case on the west coast of India. The less southerly or the more northerly the wind, the finer is the weather, and the smaller the rainfall of the Bombay Presidency. The explanation of these facts is that, at certain times, a considerable portion of the air which enters into the western branch of the monsoon is not drawn from equatorial regions at all, but from the dry coasts or still drier plains and mountains to the north. In all years, in the summer season, this dry air furnishes the greater part of the winds of the Lower Indus Valley and Western Rajputana, and hence the rainlessness of this portion of Western India. And according to the variation of atmospheric pressure over the continent of Asia, so does it enter in larger or smaller proportion into the wind current which sweeps the northern half of the Arabian Sea, and carries drought, either temporary or prolonged, to Guzerat, Khandesh or the Deccan.

These corrections of the prevalent conception of the character of the summer monsoon have therefore a practical bearing of very considerable importance. The next step towards an explanation of the causes of drought and famine will be to ascertain, if possible, what circumstances favour and what are adverse to the extended prevalence of the dry northerly element of the monsoon. These have been briefly alluded to in the forecast of the monsoon of 1885, quoted on a preceding page; there are now very good grounds for believing that an unusual extent of snow on the mountain tract of Beluchistan, Afghanistan and the North-Western Himalaya favours the dry northerly element of the monsoon. But there are also grounds for believing that this cause and therefore its effects are not very lasting, and that great droughts, such as those of 1876 and 1877, depend on atmospheric conditions of much wider prevalence.

INFLUENCE OF FORESTS ON CLIMATE.—*Forest Observatories.*—Some time before Dr. Brandis's retirement from the office of Inspector General of Forests with the Government of India, he consulted me on the establishment of observatories in connection with the forests, with a view to ascertaining the effect of forests, more especially on temperature and rainfall. Observations of this kind have been made somewhat extensively in Europe, and the work of Ebermeyer[1] on the results of five years' systematic observations, at comparative observatories (within and without the forests) in Bavaria, is a well-known standard treatise on the subject.

As the result of this consultation, the first step taken in the Forest Department was to establish an observatory at the Forest School at Dehra-Dun, which should serve as a model for the forest observatories and a training school for observers. Arrangements were made, by Dr. Warth, for recording temperature, the humidity of the air and the rainfall near the ground and also 66 feet above it, and these observations have been carried on regularly, from October 1882 up to the present time.

In July 1884, the first pair of comparative observatories was started at the Forest Nursery, Ajmere; they were less complete in plan than the Dehra model, sheds of similar pattern being erected under the trees of the forest and in the open ground outside the forest; and readings of the maximum, minimum and 10h. and 16h. temperatures were recorded with thermometers therein exposed, the instruments having been previously verified at the Alipore Observatory. In this case, rainfall was recorded only outside the forest.

In August 1885, another pair of observatories, similarly furnished, was established at the Mohwa Bir Forest, Ajmere, and from the beginning of the present year (1886) comparative measurements of rainfall have been made both within and without six forests in the Ajmere-Merwara reserves.

In June 1884, comparative observatories were established in the Dun at the Ramgarh forest, and in March 1885, a similar pair in the Rajah's forest, by Mr. Fisher, the Director of the Forest School. These are on the same plan as the model observatory at the Dehra Forest School; observations of temperature, humidity and rainfall being recorded both near the level of the ground and also at an elevation of 60 feet above it, on a structure originally designed and constructed by Dr. Warth.

The results of these observations, so far, seem to show slightly but appreciably higher rainfall in the forest than without. Before, however, this can be accepted as a valid generalization, unquestionably a careful enquiry must be made into the possible existence of other circumstances affecting the contents of the rain-gauge, besides that obvious difference of position, the effects of which is the aim and object of the observations to gauge;[2] but it is certainly noteworthy that the large majority of the comparative observations up to the present time seem to point out in the same direction. They are as follow:—

---

[1] Die Physikalischen Einwirkungen des Waldes auf Luft und Boden. Dr. Emst Ebermeyer. Wiegaudt; Hempel und Paery, Berlin, 1873.

[2] One precaution that I have recommended to the Director of the Forest School is for the ensuing year to exchange the gauges and measure-glasses used respectively inside and outside the forest.

Comparative measurements of rainfall within and without forests.

RAMGARH FOREST, DEHRA DUN.

	Rain-gauges on ground.			Rain-gauges 60 feet above ground.		
	I In forest.	O Outside.	Difference. I—O	I In forest.	O Outside.	Difference. I—O
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
June (16th—30th) 1884	4·07	3·66	0·41	3·88	3·61	0·27
July 1884	26·46	25·64	0·82	26·44	24·72	1·72
August "	21·74	21·18	0·56	21·23	19·88	1·35
September "	18·78	17·53	1·25	18·01	17.19	0·82
October "	0·39	0·28	0·11	0·37	0·26	0·11
November "	0	0	0	0	0	0
December "	0	0	0	0	0	0
January 1885	4·48	4·20	0·28	4·63	4·56	0·07
February "	0·70	0·85	—0·15	0·67	0·77	—0·10
March "	0·39	0·48	—0·09	0·36	0·42	—0·06
April "	0·55	0·44	0·11	0·50	0·45	0·05
May "	5·99	5·35	0·64	5·79	5·06	0·73
June "	10·76	10·31	0·45	10·61	9·75	0·86
July "	9·90	9·81	0·09	9·88	9·27	0·61
August "	44·91	44·64	0·27	44·45	43·56	0·89
September "	5·51	6·24	—0·73	5·47	6·06	—0·59
October "	0	0	0	0	0	0
November "	0	0	0	0	0	0
December "	3·49	3·45	0·04	3·52	3·48	0·04
TOTALS	158·12	154·06	+4·06	155·81	149·04	+6·77

RAJAH'S FOREST, DEHRA DUN.

	Rain-gauges on ground.			Rain-gauges 60 feet above ground.		
	I In forest.	O Outside.	Difference. I—O	I In forest.	O Outside.	Difference. I—O
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
April 1885	0·42	0·06	0·36	0·36	0·32	0·04
May "	3·99	4·69	—0·70	4·04	4·36	—0·32
June "	11·70	10·47	0·23	11·42	10·07	0·35
July "	10·63	9·81	0·82	9·58	9·47	0·11
August "	45·87	47·50	—1·63	45·87	46·99	—1·12
September "	2·46	2·43	0·03	2·41	2·40	0·01
October "	0	0	0	0	0	0
November "	0	0	0	0	0	0
December "	3·54	3·40	0·14	3·45	3·43	0·02
TOTALS	78·61	78·36	+0·25	77·13	77·04	+0·09

AJMERE-MERWARA FORESTS.

	Mohwa Bir.			Madar hill.			Nag Pahar.		
	Inside.	Outside.	Difference.	Inside.	Outside.	Difference.	Inside.	Outside.	Difference.
January 1886	0·10	0·08	0·02	0·15	0·12	0·03	0·08	0·05	0·03
February ,, ...	0·04	0·03	0·01	0·02	0·02	0	0	0	0
March ,, ...	0	0	0	0	0	0	0	0	0
Totals .	0·14	0·11	0·03	0·17	0·14	0·03	0·08	0·05	0·03

	Danta.			Rajgarh.			Dilwara Bir.		
	Inside.	Outside.	Difference.	Inside.	Outside.	Difference.	Inside.	Outside.	Difference.
January 1886	0·30	0·32	—0·02	0·35	0·25	0·10	0·08	0·07	0·01
February ,, ...	0·05	0·04	0·01	0	0	0	0	0	0
March ,, ...	0	0	0	0	0	0	0	0	0
Totals .	0·35	0·36	—0·01	0·35	0·25	0·10	0·08	0·07	0·01

The obvious tendency of these results is to show that the existence of forest increases the rainfall; and although, at present, the evidence is very far from conclusive, I should be by no means surprised if this tendency is confirmed by further and more rigorously conditioned experience. Even admitting this, it may however be contended that the differences shown are but small; appreciable but not important. But this would be a hasty and unwarranted conclusion. The pairs of observatories contrasted are, it must be remembered, in near proximity to each other, in all cases probably less than a mile, in some less than a quarter of a mile apart; and the influence of a forest, if real, does not abruptly end at the boundary of the forest tract, but must extend to a certain distance beyond its borders; while, for some distance within those borders, it is weakened by the proximity of the open country. Hence, any difference that may be shown by these pairs of stations in respect of rainfall, in so far as it is dependent on the presence or absence of forests, is probably considerably less in amount than would be shown, were it possible to contrast the rainfall of a large area under forest with that of the same area denuded and brought under cultivation. But it is almost impossible to institute a valid comparison of such areas on the large scale, because we can never be sure that the results are unaffected by conditions other than those which are the especial subject of the test.

If such influence is real, it may be confidently expected that the effects will be much greater in India than in Europe or most extra-tropical countries; such being the rule in the case of those meteorological actions that bear most affinity to that in question. I may cite, as an illustrative instance, the very remarkable diurnal variation of the rainfall shown by the Calcutta registers. In extra-tropical countries, any variation of the rainfall according to the time of day is but small, and to be detected only on the comparison of a very long series of registers. But, in Calcutta, it is so marked as to be a subject of ordinary observation; and the registers of no more than seven years suffice to show that, in the hot season, the rainfall at 7 P.M., the hour of maximum, is more than twenty times as great as at 6 A.M., which is that of minimum rainfall.

The question of the influence of forests on rainfall has lately been made the subject of a very interesting paper by the eminent Russian Meteorolgist Mr. A. Woeikoff. In this, he draws largely upon India for evidence in support of his view, which is substantially that which I am myself inclined to regard as probable. In some cases, doubtless, the want of local knowledge has led him to over-estimate the effect of forest, and to treat as comparable, with reference thereto, instances which are largely affected by other conditions, such as exposure to winds from a dry quarter, to the prevalence of swamps, and the influence of hills. Owing to this defect in the selection of evidence, his conclusions have not commanded that general assent, to which they may perhaps hereafter be entitled. For this, we must look to a critical discussion of the further data which our Indian rainfall records are now yielding, and to more extensive observation, under the rigorous conditions of scientific experimental enquiry, which it may be within the power of the Forest Department to carry out. But speaking for myself, I must admit that, as the result of the extended experience and enquiry of late years, I have been more and more impressed with the growing evidence in favour of the view which Mr. Woeikoff advocates, and while I must necessarily admit that crucial and convincing proof is still wanting, the general tendency of the evidence is so decidedly favourable, that I can hardly regard the long-suspected influence of forests on rainfall as a question of equally balanced probabilities.

Mr. Ribbentrop, the Officiating Inspector General of Forests with the Government of India, has lately drawn my attention to a case of an apparent increase of the rainfall in consequence of forest protection, which is certainly striking, although like other cases of the kind, defective in some particulars as evidence and therefore not decisive. In preparing the data for the chart of the average rainfall of India, published in 1883, I had noticed that, the rainfall average of most stations in the Central Provinces was somewhat higher, if derived from the previous 10 or 12 years, than when obtained from longer periods; but as very little is known of the circumstances under which the registers had been kept, I attached no special meaning to the fact. A few months since, however, Mr. Ribbentrop, starting from the fact that extensive tracts of forest, previously devastated by jungle fires with a view to the nomadic system of cultivation practised by the hill tribes, had been brought under protection in 1875, and that thereby the area of vigorous forest growth had been enormously increased, was led to enquire whether this measure had sensibly affected the rainfall, and applied to my office for such records as might throw light on the subject. Comparing the rainfall of the years subsequent to 1875 with that of the years anterior to that date, he finds that the former, in all or nearly all cases, largely exceeds the latter, and he attributes this increase to the preservation of the forests.

The region which must be chiefly affected, supposing that forest protection has really had the influence attributed to it, would be the Satpura, the hilly tract that runs across the Central Provinces between the Nerbudda and the plain of Nagpur and Raipur. For this region, we have complete rainfall registers extending from 1865 or 1867 up to the present time, at the stations enumerated in the following table. I have taken the average of the annual rainfall from the 9 to 11 years ending with 1875, and also that of the subsequent 10 years. The comparison of the two is shown in the following table:—

	Forests unprotected.		Forests protected.		Increase of annual average.
	Period.	Average rainfall.	Period.	Average rainfall.	
		Inches.		Inches.	
Badnur	1867—1875	39·83	1876—1885	47·83	+8·00
Chhindwara	1865—1875	41·43	1876—1885	48·48	+7·05
Seoni	1865—1875	52·07	1876—1885	54·76	+2·69
Mandla	1867—1875	53·58	1876—1885	56·32	+2·74
Burha	1867—1875	64·51	1876—1885	71·65	+7·14
Bilaspur	1865—1875	41·85	1876—1885	54·81	+12·96
Raipur	1866—1875	51·59	1876—1885	54·41	+2·82
AVERAGE .		49·27		55·47	+6·20

The rainfall registers of Jubbulpore at the northern foot of the Satpuras, and that of Nagpur on the south, the one extending over 40 years, the other over 37 years, show that the average rainfall of a station, if derived from a period of 10 years only, has a probable error of 5 per cent., or of between 2 and 3 inches in the case of the stations enumerated. Further, it appears from a tabular summary of the rainfall of India since 1864, that the annual average of the whole country, for the 10 years, 1876-1885, was 0·66 inch greater than that for the 11 years, 1865-1875. About half the average difference shown in the above table of the Satpura stations must then be deducted, before we are justified in regarding the increase as even probably the result of some cause locally operating. The residue may fairly be regarded as indicating some such cause, but having regard to our ignorance of the circumstances under which most of the rainfall registers have been kept, it could hardly be confidently asserted that that cause is the conservation of the forests, and no other. Nevertheless, the facts, if not logically convincing, at least may be regarded as an addition of some importance to the accumulating evidence bearing on the subject.

THE FALSE POINT CYCLONE.—*Extension of the Bengal Storm-warning System.*— On the 22nd September 1885, a cyclone, small in extent but accompanied by high storm wave, devastated the settlement of Hookeytolla at False Point in Orissa. The terrible destruction of life and property which resulted from this storm, aroused public attention to the subject of storm warnings to the coast ports, and has led to the adoption of measures for extending the system, which had been devised mainly, if not exclusively, for the protection of the port of Calcutta.

It appeared from the experience of this storm, which was one of remarkably rapid progress, that a system of weather telegraphy which furnishes only one set of reports daily, though probably, in all cases, sufficient to admit of the coast ports being warned that a storm exists over the Bay, and even to assign its approximate latitude, is insufficient to allow of any precise determination of its probable course, and therefore of the issue of special warnings to that part of the coast which may be more immediately threatened by its onset. And although it is usual, on such occasions, to call for extra telegrams from certain stations, if the advance of a storm is rapid, these extra reports may not be received in time to allow of a further warning being issued on them, before the storm bursts on the coast.

It has, therefore, been arranged that, whenever the telegraphic reports show that a storm is in existence over the Bay, an intimation to that effect shall be sent to the Port Officers of the chief ports on the Indian coast, and that they be instructed to depend on their own observations of the wind and barometer, for taking such precautions as the approach of the storm may render necessary; it being understood that, although further warning will be sent if possible, the absence of such warning is not to be understood as implying the absence of danger. This system in now is operation.

FLOOD WARNINGS, BOMBAY.—The plan, adopted in 1884, of communicating to the district officers and Political Agents of Khandesh and Guzerat, warnings of heavy rain in the drainage basins of Tapti and Nerbudda, and also of the approach from the Bay of Bengal of storms likely to produce such rainfall, with a view of forewarning them of floods in these rivers, has been in operation during the past season.

On the 18th June the following telegram was sent to the Collectors of Ahmedabad, Kaira and the Panch Mehals, and to the Political Agents of Rewa Kantha and Mahi Kantha: "Small storm moving westwards from Bengal. May possibly bring heavy rain to Guzerat." And on the 20th, when the storm had reached the neighbourhood of Sambalpur, further notice was sent by urgent telegram to the Collectors of Khandesh, Surat and Broach, and to the Agent of the Governor General, Baroda. The Superintendents of certain Observatories in the Central Provinces were at the same time warned by telegraph to report direct by telegraph to the above officers, if heavy rain (exceeding 3 inches in the 24 hours) should be registered. This storm, however, did not travel further westward, and there was consequently no flooding of the western rivers.

On the 28th June another storm was reported. This was formed about the Sandheads on the 26th, and on the 27th and 28th, travelled rapidly towards Allahabad, pursuing therefore a much more northerly course than its predecessor. It produced a very heavy fall of rain (6 inches) at Hoshangabad, and this was at once telegraphed to the officers in Guzerat, but the storm continued its course towards the Upper Provinces, and soon after broke up. There were no floods of a disastrous character in the Western Presidency, and indeed drought and not flood was the characteristic of the season.

MARINE METEOROLOGY.—The charts of barometric pressure, winds and currents in the Bay of Bengal for each month of the year, having been recast in accordance with suggestions received from the Officers and Weather Institutes that had been consulted, as reported last year, have been lithographed, and those for several months have now been printed off. The complete work will, it is hoped, be issued in the course of the present year.

Good progress has been made with the preparation of similar charts for the Arabian Sea, and Mr. Dallas has also drawn up a set of charts, illustrating the varying density of the sea-water of the Bay of Bengal for four seasons of the year.

Weather logs relating to the Bay of Bengal are still received from Commanders of vessels reaching the port, on the plan devised and carried out by Mr. Eliot. One hundred and sixty-one of these have been received during the past year.

INSPECTION OF OBSERVATORIES.—Special arrangements were made during the past cold season for the inspection of a larger number of observatories. Mr. Dallas was deputed to inspect four of those in Rajputana and Central India, two in the Punjab, one in Bombay and one in the Central Provinces. Mr. F. Chambers to the five observatories of Berar, four others in the Central Provinces and one in Bombay. And the Meteorological Reporter to the Government of India inspected three others in the Central Provinces, and subsequently, one in Bengal, five in the North-Western Provinces, four in the Punjab, one in Beluchistan, three in Sind and four in Madras. The Meteorological Reporters for Bengal, the North-Western Provinces and Madras, and the Officiating Reporter for the Punjab have also inspected several of their observatories, and thus by one or another officer of the Meteorological Department, the following observatories reporting to the Imperial Department have been subject to inspection during the year:—

BENGAL AND ASSAM . .	Dhubri. Bankipore (Patna). Hazaribagh. Darjeeling. Durbhanga. Calcutta (Alipore). Gya.
NORTH-WESTERN PROVINCES AND OUDH . .	Benares. Allahabad. Agra. Lucknow. Bareilly. Ranikhet. Pithoragarh. Chakrata. Meerut. Jhansi. Dehra.
PUNJAB . .	Lahore. Mooltan. Peshawar. Rawalpindi. Chamba. Simla. Ludhiana. Delhi. Sirsa. Sialkot. Murree.
CENTRAL PROVINCES . .	Nagpur. Jubbulpore. Pachmarhi. Hoshangabad. Seoni.
CENTRAL PROVINCES.—*contd.*	Khandwa. Chanda. Raipur.
BERAR . . .	Akola. Buldana. Chikalda. Amraoti. Makhla.
CENTRAL INDIA AND RAJPUTANA . .	Neemuch. Indore. Mount Abu. Ajmere. Sambhar.
BOMBAY . . .	Kurrachee. Jacobabad. Hyderabad. Rajkot. Surat. Malegaon.
MADRAS . . .	Bangalore. Bellary. Coimbatore. Cuddapah. Madura. Mangalore. Mercara. Negapatam. Salem. Trichinopoly. Wellington.
BELUCHISTAN .	Quetta.

About half the observatories have therefore been inspected during the past year.

PART II.—DETAILS OF ADMINISTRATION.

OBSERVATORIES.

At the commencement of the year under report, there were 128 observatories in India and elsewhere, contributing original registers to this office. A new observatory was opened at Tezpore in Assam on the 2nd April 1885, and a voluntary observatory, furnished with instruments from this office, has been established at Baroda and began work on the 26th January 1886. There have also existed observatories at Calicut and Coconada for some years past in connection with the Bombay and Bengal Storm-warning Systems, but the registers have not been communicated to the Central Office. These have now been called for.

On the other hand, the voluntary observatory at St. Fidelis' School, Mussooree, had become so irregular in its working, as to be of little or no value to the department, and the instruments were therefore withdrawn in November 1885, the registers having ceased some months previously. Thus, at the close of the year, there were 131 observatories working in connection with the department. These are enumerated in the following list which also specifies the class to which they belonged at the close of the year. The classes are:—

1st Class, furnished with autographic instruments for pressure, temperature, humidity, rainfall and wind registration, either continuously or at short (10 minutes') intervals.

2nd Class.—Hourly observations recorded on four days in each month; on other days, 3 times during the day. Or observations recorded daily 4 times at intervals of 6 hours. Certain of these observatories are also furnished with anemographs for the continuous registration of the wind.

3rd Class.—Observations of pressure, temperature, &c., recorded twice daily, *viz.*, at 10 A.M. and 4 P.M., and measurement of rainfall at 6 P.M.

4th Class.—Observations of temperature, wind and rainfall only, similarly recorded.

BENGAL AND ASSAM.

	Class.		Class.		Class.
Dhubri	2nd	Darjeeling	3rd	Calcutta (Alipore)	1st
Tezpur	3rd	Purneah	,,	Do. (Chowringhee)	4th
Sibsagar	,,	Durbhanga	,,	Demagiri	,,
Silchar	,,	Gya	,,	Mongpoo	,,
Bankipore (Patna)	,,	Berhampore	,,	Tura	,,
Hazaribagh	,,	Burdwan	,,	Pedong	3rd
Saugor Island	2nd	Jessore	,,		
Cuttack	3rd	Dacca	,,		
Chittagong	,,	False Point	,,		

NORTH-WESTERN PROVINCES AND OUDH.

	Class.		Class.		Class.
Allahabad	1st	Mussooree (Surveyor Genl.'s office)	3rd	Meerut	3rd
Agra	3rd	Dehra (Surveyor Genl.'s office)	,,	Gorakhpur	,,
Lucknow	,,	Do. (Forest School)	4th	Ghazipur	,,
Roorkee	,,	Bareilly	3rd	Benares	,,
Chakrata	,,			Jhansi	,,
Ranikhet	,,			Pithoragarh	,,

PUNJAB.

	Class.		Class.		Class.
Lahore	2nd	Murree	3rd	Kailang	3rd
Mooltan	3rd	Sialkot	„	Delhi	„
Dera Ismail Khan	„	Ludhiana	„	Sirsa	„
Peshawar	„	Chamba	„		
Rawalpindi	„	Simla	„		

CENTRAL PROVINCES.

	Class.		Class.		Class.
Nagpur	2nd	Hoshangabad	3rd	Sironcha	3rd
Jubbulpore	„	Seoni	„	Raipur	„
Pachmarhi	„	Khandwa	„	Sambalpur	„
Saugor	3rd	Chanda	„		

BERAR.

	Class.		Class.		Class.
Akola	3rd	Chikalda	3rd	Makhla	4th
Buldana	„	Amraoti	„		

CENTRAL INDIA AND RAJPUTANA.

	Class.		Class.		Class.
Jeypore	1st	Indore	3rd	Sambhar	3rd
Sutna	3rd	Mount Abu	„	Bickaneer	„
Nowgong	„	Pachpadra	„		
Neemuch	„	Ajmere	„		

BOMBAY.

	Class.		Class.		Class.
Colaba (Bombay)	1st	Jacobabad	3rd	Baroda	3rd
Belgaum	2nd	Hyderabad (Sind)	„	Surat	„
Poona	„	Bhuj	„	Malegaon	„
Deesa	„	Rajkot	„	Ratnagiri	„
Kurrachee	„	Sholapur	„	Karwar	„

MADRAS.

	Class.		Class.		Class.
Vizagapatam	2nd	Kurnool	3rd	Madura	3rd
Bellary	„	Cuddapah	„	Calicut	„
Trichinopoly	„	Madras	„	Wellington	„
Gopalpur	3rd	Bangalore	„	Mercara	„
Coconada	„	Negapatam	„	Mangalore	„
Masulipatam	„	Salem	„	Rajamundry	„
Secunderabad	„	Coimbatore	„	Cochin	„

BURMA.

	Class.		Class.		Class.
Rangoon	2nd	Akyab	3rd	Toungoo	3rd
Bassein	3rd	Thayetmyo	„	Moulmein	„
Diamond Island	„	Mergui	„		

BAY ISLANDS.

	Class.		Class.
Port Blair	3rd	Nancowry	3rd

EXTRA INDIAN.

	Class.		Class.		Class.
Leh	2nd	Bushire	3rd	Katmandu	3rd
Aden	„	Quetta	„	Amini Divi (Lakhadives)	„

During the year the following observatories, formerly of the second class, having contributed hourly observations for at least ten years, were reduced to the third class, excepting that the anemographs have been retained at those stations which possessed them, and the synoptic observations, recorded at Greenwich mean noon, are continued :—

Roorkee
Agra
Lucknow
Patna
Hazaribagh
Cuttack
Sibsagar
Chittagong

and one, *viz.*, Allahabad, has been raised to the status of a first class observatory.

OBSERVATORIES IN BENGAL AND ASSAM.—*The Alipore Observatory.*—This observatory serves as a general depôt for the verification of instruments, as well as for observations of an experimental character, and an important part of the work is the working of the time signals for the port of Calcutta. It is immediately superintended by the Reporter to the Government of India, and the establishment is under the charge of the Chief Observer, Babu Brojo Mohun Rakhit, B.A. During the past year the work of the observatory has consisted of—

1st.—Continuous registration, by autographic instruments, of (*a*) the duration of bright sunshine, (*b*) the atmospheric pressure, (*c*) temperature, (*d*) moisture (dry and wet bulb thermometers), (*e*) wind direction, movement and pressure, and (*f*) rainfall.

2nd.—Periodical readings, five times daily, of the barometer, dry and wet bulb thermometers, measurements of rain and estimates of cloud proportion, once daily of the maximum and minimum thermometers in shade, those of the exposed thermometers for nocturnal radiation and insolation, and thrice daily those of ground thermometers at the surface, 1 foot, 3 feet, and once at 6 feet deep. Also occasional observations on the movements of the higher clouds by means of the nephescope.

3rd.—The verification of all thermometers issued to observatories throughout India, with the exception of those under the Meteorological Reporter for Western India, and the comparison of all barometers with the Calcutta standard.

4th.—The determination of the mean local time, by meridian observations of the sun, and the working of the time signals for the guidance of the shipping in the port. Also the custody and rating of Government chronometers.

The establishment for the above purposes consists of—

Babu Brojo Mohun Rakhit, B.A., Chief Observer.
„ Annoda Prosad Banerjee, B.A., 1st Photo. Assistant.
„ Ram Chandra Chackravarty, 2nd ditto.
„ Mahendro Nath Banerjee, Observer.
„ Shyam Lall Sen, Observer.
2 Artificers.
1 Batteryman.
6 Servants.

The autographic instruments consist of a sunshine recorder, the Kew barograph and thermograph, which register by photography, a Beckley's anemograph, and Osler's anemometer and a Beckley's rain-gauge. During the past year, with but slight exceptions, the instruments have worked well.

The interruptions of the photographic records though more frequent than is desirable, owing chiefly to the imperfect working of the instruments, have been of short duration, rarely exceeding one or two hours.

It was mentioned in last year's report, that in March 1884, a bubble of air had penetrated the Torricellian vacuum of the barograph barometer-tube, causing a depression of the column and altering the zero value of the instrument. Since then, the barograph trace measurements at the hours of reading the standard barometer have been compared with the eye readings of the latter instrument month by month, and a correction applied to the former to equalize them to the latter. The results of these comparisons are given in the following table :—

Comparative mean reduced readings of barograph and standard barometer in 1885.

1885.	Standard barometer.					Barograph.				
	6 hours.	10 hours.	16 hours.	22 hours.	Mean.	6 hours.	10 hours.	16 hours.	22 hours.	Mean.
January . . .	30·070	30·144	30·013	30·076	30·076	30·038	30·119	29·986	30·051	30·049
February . . .	29·951	·025	29·901	29·964	29.960	29·923	·002	·876	29·942	29·936
March	·897	29·963	·833	·910	·901	·873	29·943	·811	·892	·880
April	·746	·804	·670	·756	·744	·726	·786	·648	·739	·725
May	·744	·792	·674	·743	·738	·722	·771	·649	·723	·716
June	·552	·588	·491	·578	·552	·521	·558	·456	·549	·521
July	·539	·574	·490	·572	·544	·504	·551	·458	·547	·515
August. . . .	·552	·594	·507	·591	·561	·516	·566	·469	·558	·527
September . . .	·726	·778	·678	·760	·736	·698	·760	·648	·736	·711
October . . .	·864	·921	·808	·878	·868	·841	·903	·782	·857	·846
November . . .	·983	30·045	·934	30·006	·992	·963	30·029	·909	·987	·972
December . . .	30·023	·089	·973	·040	30·031	30·004	·074	·952	30·022	30·013
YEAR .	29·804	29·860	29·748	29·823	29·809	29·777	29·839	29·720	29·800	29·784

The constancy of the standard (Newman's No. 109, with a constant correction of —0·005 to assimilate it to the old Calcutta standard,) is verified by series of comparative readings, made at intervals of 6 months, with two other barometers of similar construction; (Newman's No. 86 and No. 112.) If there has been any change in their relative values since July 1883, it is in a slight depression of the two secondary standards or perhaps in No. 109 only, but this is doubtful.

The following table gives a comparison between the eye readings of the compared and corrected thermometers under the thermometer shed at Alipore, with the corresponding thermograph traces, which shows that the relative values of the dry bulbs have remained unaltered. The difference of the wet bulbs has apparently increased by 0·2°, but as the exposure of the instruments is not the same, it may be due to some change in the local conditions affecting the readings.

Comparative mean readings of the thermograph and dry bulb thermometer in the thermometer shed in 1885.

1885.	THERMOMETER IN SHED.					THERMOGRAPH (DRY BULB.)				
	6 hours.	10 hours.	16 hours.	22 hours.	Mean.	6 hours.	10 hours.	16 hours.	22 hours.	Mean.
	°	°	°	°	°	°	°	°	°	°
January . . .	58·7	69·4	76·9	62·7	66·9	59·5	68·1	75·4	63·2	66·6
February . . .	61·0	70·7	77·2	65·1	68·5	62·0	70·2	76·4	65·9	68·6
March	70·9	82·1	88·8	75·5	79·3	72·0	81·4	88·1	76·5	79·5
April	76·8	89·9	97·0	80·9	86·2	78·2	89·6	96·6	82·4	86·7
May	78·1	89·4	91·4	80·4	84·8	79·4	89·9	91·9	81·7	85·7
June	80·6	87·1	88·2	81·6	84·4	81·5	88·0	89·1	82·5	85·3
July	79·4	84·6	85·2	80·8	82·5	80·3	85·3	86·1	82·4	83·5
August . . .	78·9	82·0	82·0	79·7	80·7	79·5	82·4	82·8	80·3	81·3
September . . .	78·8	83·6	84·3	80·5	81·8	79·5	83·9	85·0	81·2	82·4
October . . .	75·7	83·3	84·6	77·1	80·2	76·6	83·0	84·7	78·0	80·6
November . . .	65·9	75·5	79·4	68·8	72·4	66·9	75·0	78·8	69·6	72·6
December . . .	59·0	68·2	73·6	61·9	65·7	59·7	67·2	72·7	62·3	65·5
YEAR .	72·0	80·5	84·1	74·6	77·8	72·9	80·3	84·0	75·5	78·2

Comparative mean readings of the thermograph and wet bulb thermometer in the thermometer shed in 1885.

1885.	WET BULB IN SHED.					THERMOGRAPH (WET BULB.)				
	6 hours.	10 hours.	16 hours.	22 hours.	Mean.	6 hours.	10 hours.	16 hours.	22 hours.	Mean.
	°	°	°	°	°	°	°	°	°	°
January . . .	57·1	61·6	63·6	60·3	60·7	57·0	61·0	63·3	60·3	60·4
February . . .	59·3	62·3	64·0	61·8	61·9	59·6	62·1	64·1	62·2	62·0
March	69·2	72·1	70·5	71·4	70·8	69·6	72·4	71·9	72·1	71·5
April	73·7	75·6	73·0	75·7	74·5	74·5	76·7	75·1	76·6	75·7
May	75·4	78·1	76·3	75·1	76·2	76·3	79·8	78·4	76·4	77·7
June	78·6	80·2	79·9	78·5	79·3	79·0	81·1	80·8	79·0	80·0
July	78·2	80·2	80·3	79·0	79·4	78·6	80·9	81·2	79·5	80·1
August . . .	77·7	78·9	78·8	78·2	78·4	78·0	79·3	79·5	78·5	78·8
September . . .	77·2	79·0	79·0	78·1	78·3	77·7	79·8	80·2	78·7	79·1
October . . .	74·6	76·5	75·5	75·2	75·5	75·2	77·4	76·6	75·8	76·3
November . . .	64·0	67·6	68·0	66·3	66·5	64·5	67·7	68·4	66·8	66·9
December . . .	57·3	61·8	62·7	59·6	60·4	57·3	61·4	62·9	59·7	60·3
YEAR .	70·2	72·8	72·6	71·6	71·8	70·6	73·3	73·5	72·1	72·4

The sunshine recorder has continued to work satisfactorily. The observations of ground temperature have been carried on as in the previous year. An abstract of the registers is given in the report on the Meteorology of India in the year 1885.

The number of instruments verified at the Alipore Observatory, during the year ending 31st March 1886, is as follows. Excepting aneroids and solar radiation thermometers, rain-gauges and measure-glasses, the number is considerably below that tested in the previous year.

Instruments.	No.
Barometers	42
Aneroids	27
Dry and wet bulb thermometers	8
Maximum thermometers for air temperature	7
Minimum do. do. do.	27
Do. do. for nocturnal radiation	28
Solar radiation thermometers	55
Standard thermometers	5
Six's do.	1
Sling do.	5
Common do.	2
Clinical do.	1
Salinometer	1
Rain-gauges	17
Measure-glasses for rain-gauges	27
Sunshine recorder	1
TOTAL	254

The following is a return of the instruments received and issued by the observatory. The instruments' store is now attached to the Calcutta Meteorological Office.

Instruments.	Received.	Issued.
Barometers	52	32
Aneroids	17	16
Dry and wet bulb thermometers	8	10
Maximum thermometers for air temperature	12	18
Minimum do. do. do.	17	28
Do. do. for nocturnal radiation	27	25
Solar radiation thermometers	44	56
Standard thermometers	0	4
Six's do.	1	1
Common do.	2	2
Clinical do.	1	1
Salinometer	1	1
Sunshine recorder	1	1
Traveller's maximum and minimum thermometers	12	0
Rain-gauges	17	17
TOTAL	212	212

The time signals have worked satisfactorily, though the occasions of failure have been somewhat more numerous than in the previous year. Both balls dropped correctly on 280 days; one failed on four days, the other on two days, making six failures in all, but as these occurred on different days, one or the other ball gave a correct time signal on 286 days. The remaining days (79) were either Sundays or public holidays.

Table showing the occasions of failure of two time balls during the official year 1885-86.

Dates of failures.	Number of failure.
8th April 1885 . . .	Time ball on the Semaphore tower, Fort William, dropped a few seconds late.
27th April 1885 . . .	Ditto ditto ditto.
29th May 1885 . . .	Ditto ditto ditto.
11th July 1885 . . .	Ditto ditto ditto.
17th October 1885 . .	Time ball at the Port Commissioners' Office failed altogether.
5th February 1886 . .	Ditto ditto ditto.

On a representation from ship masters in the port, of the inconvenience arising from the suspension of the time signal service on Sundays and holidays, and also of the importance of signalling at once to the shipping any inexactitude in the working of the signals, this office has been in correspondence with the Government of Bengal, with a view to making the service continuous, and also of providing means for signalling the occurrence of a failure. The subject is still under the consideration of the Bengal Government.[1]

OTHER OBSERVATORIES IN BENGAL AND ASSAM.—A list of the observatories reporting to the office of the Imperial Government has been given at page 16. Those reporting only to the Provincial Office are enumerated below in a foot-note.[2]

Some extracts from Mr. Pedler's report, on the condition and working of the observatories under his charge, is given in Appendix A. Of the observatories on the Imperial list, ten (exclusive of the two Calcutta observatories) have been inspected during the past year, *viz.*, Darjeeling, Bankipore (Patna), Dhubri, Hazaribagh and Durbhanga, by Mr. Pedler, Gya by myself, and Saugor Island, Purneah, Jessore and Dacca by Mr. Pedler's Head Clerk. That of Dhubri, fomerly an excellent observatory, was found to be in a very unsatisfactory condition, owing to the incompetence of the man, (formerly Assistant observer,) who had been appointed Observer on the death of his predecessor. He has been given notice of dismissal and his place will shortly be supplied by a man trained to his work at Alipore.

The site of the Purneah Observatory has deteriorated in point of exposure, owing to the growth of trees round about it, and it will have to be removed, however much such a step may be regretted on general grounds.

---

[1] Since the above was written, the proposals have been sanctioned and the service is now uninterrupted.

[2] The observatories established for the system of daily local report in Bengal are the following :—

Balasore.
Midnapore.
Raneegunge.
Noakholly.
Burrisal.
Serajganj.
Comillah.
Furreedpore.
Mymensingh.
Rampore Bauleah.
Dinagepore.
Rungpore.
Bankoora.
Julpigoree.
Bhagalpore.
Chupra.
Motiharee.
Buxar.
Arrah.
Krishnagar.
Dehree.
Nya Doomka.
Ranchee.
Chybassa.
Bogra.
Maldah.

The Jessore Observatory was found to be in an unsatisfactory condition, and the special allowance previously granted to the Observer has been suspended in consequence.

The Dacca Observatory was also found to be somewhat defective. That of Gya, which was inspected by myself in December, was, on the whole, better than I had expected, but the Meteorological Reporter to the Government of Bengal has had occasion to censure the Observer on more than one occasion, and it is certain that, from whatever cause, his barometric registers have been open to much doubt.

The False Point Observatory was seriously injured in the cyclone of the 23rd September, the thermometer shed being blown away, and the anemometer blown down. Very valuable observations of the barometer were made during the passage of this storm by Mr. Workman, the Observer. Telegraphic communication with Calcutta was in abeyance up to the 6th January, and during this interval, the storm signal service was deprived of one of its most important reporting stations.

A new observatory of the 3rd class has been established at Tezpur, in Assam. It began to work on the 2nd April 1885, but, as yet, has hardly been up to the required standard.

Respecting other observatories in Bengal and Assam, there is little to remark. They have worked satisfactorily, and in many cases excellently well.

Special allowances have been granted for the present year to the Observers enumerated as follows :—

Names.	Stations.	Amounts. R
Makhadaprosad Chowdhuri	Burdwan	10
Mahendra Nath Roy	Berhampore	10
Dandadhar Datta Barua	Sibsagar	10
W. H. Alley	Cuttack	5
Nathu Lall	Hazaribagh	5
Ramesh Chundra Bhadra	Silchar	5
Jogin Chundra Banerji	Durbhanga	5

OBSERVATORIES IN THE N.-W. PROVINCES AND OUDH.—It has already been noticed, in Part I of this report, that the observatory at Allahabad, hitherto ranking as one of the 2nd class, has been raised to the status of a 1st class observatory, and has been removed to the new building specially constructed for it in the Chatham lines, and furnished with a meteorograph which records autographically. Readings of the ordinary instruments are recorded by eye at intervals from 5h. 50m. A.M. up to 10 P.M., but the hourly readings of all instruments, formerly recorded on four days in each month during 25 hours in succession, have been discontinued, as well as those hitherto taken daily at 4 A.M.

As the removal of an observatory always introduces some change in the normal or average temperature, humidity, &c., no two sites being exactly alike in these respects, and as it is a matter of great importance that the registers of any future year shall be rigorously comparable with those of past years, observations have been made simultaneously, twice a day, at the new and old observatories, since the beginning of September 1884, and they will be continued till the expiration of two complete years. In the extracts from his Administration Report, (Appendix B,) Mr. Hill notices the differences, which have thus become apparent, in the effects of the two sites on the instruments, and traces them to their probable causes.

The establishment of the Allahabad Observatory consists of—

Babu Kader Nath Chatterjee, Head Observer.
,, Sashibhusun Banerjee, Second ,,
,, Jadu Nath Chatterjee, Third ,,
1 Electrician occasionally and casually.
1 Artificer ,, ,,
1 Printer ,, ,,
and 4 menial servants.

The work of the observatory consists of—

1st.—Registering autographically, at intervals of ten minutes, by means of Van Rysselberghe meteorograph, the readings of the barometer, dry and wet bulb thermometers, direction and distance travelled by the wind, and the amount of the rainfall. The register is engraved on a prepared metallic plate, which is afterwards etched, and from which any required number of copies can be printed off.

2nd.—Periodic readings, five times daily, of the barometer, dry and wet bulb thermometers, &c., &c., and once daily of maximum, minimum air temperature, and radiation thermometers, and thrice daily of the ground thermometers at the surface, 1 foot, 3 feet and 9 feet deep, &c., as at the Alipore Observatory. Also the registering of the duration of bright sunshine, and observations on the movements of the higher clouds with a Marie Davy nephescope.

The meteorograph having been brought into good working order, only at the end of the year, no comparison has yet been made between its registers and the eye readings of the ordinary instruments. The latter will continue to furnish the standard values, and the registers of the autographic instruments corrected to them when necessary.

The new observatory accommodates the Meteorological Reporter's Office as well as the observatory establishment.

The three observatories of Lucknow, Agra and Roorkee have hitherto worked as second class observatories, furnishing, in addition to three daily series of observations, hourly readings of all instruments for 25 consecutive hours, four times in each month. As more than ten years of these registers have now been recorded, and these suffice to show the normal diurnal variation of the chief meteorological elements, the hourly registers were discontinued at the end of 1885, and a reduction made in the cost of these observatories. Since the beginning of the present year, they have furnished the same observations as 3rd class stations, with the addition of synoptic observations as a part of the international system in correspondence with the United States Meteorological Department, and which it is intended to continue indefinitely.

In June and July, the observatory at Lucknow was, in part, transferred to a different but neighbouring building, the Tashat Baksh. The change, thus introduced, really however affects only the wind registers, the anemograph having been set up on the roof of the present building. The barometer, in a lower room, is at exactly the same elevation as formerly, and the thermometer shed and instruments have not been moved. The observatory was inspected by Mr. Hill in April 1885, and everything found to be in a satisfactory condition.

Roorkee Observatory has not been visited, but has continued to work well.

The Agra Observatory was visited by myself in December 1885 and found to be in very good order. The chief instruments were re-verified, the barometer cistern cleaned, &c.

Other observatories in the North-Western Provinces, inspected by myself on this tour, are those of Benares, Meerut and Chakrata, and I also visited that attached to the Office of the Survey of India at Dehra. Mr. Hill has inspected Bareilly, Ranikhet, Pithoragarh and Jhansi, also the Benares Observatory on more than one occasion. At all these the barometers and thermometers were re-verified. The observatories of Benares, Chakrata, Pithoragarh and Ranikhet were found to be in excellent order; the others somewhat less so. The Observers at Jhansi and Gorakhpur have both been fined for carelessness. Special meritorious allowances have been conferred on the following Observers for the ensuing year:—

Names.	Stations.	Amounts. R
Chotay Lall	Lucknow	10
Jewa Nand	Ranikhet	10
Chiranji Lall	Roorkee	10
Mir Altaf Ali	Agra	5
Sher Singh	Pithoragarh	5

OBSERVATORIES IN THE PUNJAB.—The observatories in this Province are the same in number and position as in the previous year, and they are enumerated on page 17. Chamba and Kailang are immediately under the Imperial Office, the remainder, under the Meteorological Reporter to the Punjab Government.

The Lahore Observatory still awaits the arrival of some of the autographic instruments, required for its outfit as an observatory of the 1st class. A self-registering rain-gauge and a Beckley's anemograph have been received, but a tower has yet to be built for the latter, and the former did not reach Lahore until after the close of the year.

Meanwhile, the observatory is carried on as one of the 2nd class, hourly observations being recorded on four days in each month. In addition to the observations made at other observatories of the same class, a register is kept of the ground temperature, from the surface down to 6 feet below it; and also the duration of bright sunshine by means of a sunshine recorder. Up to the end of November 1885, the observatory was under the immediate superintendence of the Meteorological Reporter to the Punjab Government, whose residence was in Lahore. But on the transfer of the Meteorological Reporter's duties to Mr. Dallas, whose head-quarters, as 1st Assistant to the Meteorological Reporter to the Government of India, are at Simla, and who permanently resides there, it became necessary to make another provision for the superintendence of the observatory, and Mr. Oman, who had officiated as Meteorological Reporter from the time of Dr. Lawrie's departure up to Mr. Dallas's assumption of that office, was appointed Superintendent of the Lahore Observatory.

A duplicate set of observations (on the scale of a 3rd class station,) is carried on at the old observatory at the Mayo Hospital, in order to determine the effect of the change of site on the normal readings of the chief instruments.

During his tenure of office as Meteorological Reporter, Mr. Oman visited the observatories of Peshawar, Murree, Rawalpindi, Sialkot, Mooltan, Ludhiana, Delhi, and Sirsa. Mr. Dallas, besides visiting Lahore, inspected the Chamba Observatory, and during my cold-weather tour, or subsequently, before proceeding to Simla, I inspected Lahore, Mooltan, Peshawar and Rawalpindi, and verified the instruments. The less accessible observatories of Dera Ismail Khan, Kailang and Leh have alone remained unvisited.

The observatories of Lahore, Peshawar, and Murree have been found, on the present as on former occasions of inspection, in excellent condition, and the work carefully and accurately performed. That of Rawalpindi was satisfactory on the occasion of my visit, and that of Mooltan also, there having been a marked improvement in its condition since it had been inspected by Mr. Oman in September 1885; that of Sialkot is stated to be satisfactory on the whole, the instruments clean and well cared for, but some small defects were noticed. The reported conditions of the Delhi and Sirsa observatories seem to afford evidence of much neglect, and that of Ludhiana observatory, though better, is not satisfactory. It is to be regretted that Mr. Oman, instead of seeing that the defects noticed were remedied at once, merely reported them to the Superintendents after his return to Lahore, and requested that the observer might be directed to correct them.

The Chamba Observatory was inspected by Mr. Dallas in November 1885. The barometer and anemometer were found to be out of order, and had to be replaced. The thermometers were in good order, but not securely suspended, and exposed to shaking by the winds. The observer is Dr. Barkhurdar Khan, a medical officer in the employ of the Rajah of Chamba, by whom he is allowed to act in the above capacity. The thermometer shed is provided at the Rajah's expense.

The Kailang Observatory has been carried on with the greatest care and attention by the Superintendent, the Reverend A. W. Heyde. In addition to the usual registers, Mr. Heyde has contributed most valuable information respecting the climate and variations of the snowfall, and has carried out a series of experimental measurements, comparing the thickness of a fall of snow with the quantity of water yielded on melting it, which have resulted in showing—1st, that the thickness of a fall of snow, if measured with due precaution and immediately after its fall, bears a nearly constant relation to the quantity of snow-water which it yields; and, 2nd, that under ordinary circumstances and when the fall is not such as to choke the gauge, the ordinary rain-gauge serves to give a very trustworthy measurement of the fall.

A list of the Superintendents and Observers is given in Appendix C.

Special meritorious allowances have been awarded to the following Observers for the ensuing year:—

Names.	Stations.	Amount. R
Jaspat Rai	Lahore	10
Devan Chand	,,	5
Kashi Ram	Peshawar	5
W. Cruikshank	Murree	5
Sergeant J. J. Konig	Simla	5

OBSERVATORIES IN THE CENTRAL PROVINCES.—These are the same as in previous years, and are enumerated at page 17.

Except those at the less accessible stations of Saugor, Sambalpur and Sironcha, all the observatories have been inspected during the year, five of them by the Sanitary Commissioner as well as by officers of the Meteorological Department. Khandwa was inspected by Mr. Dallas; Nagpur, Raipur, Seoni and Chanda, under instructions from my office, by Mr. Chambers; and Hoshangabad, Pachmarhi and Jubbulpore by myself in November last.

The Nagpur Observatory was found to be in excellent order as regards all the ordinary instruments, and the observer P. Soobiah read all the instruments accurately. But the large anemograph was found to be working very stiffly for want of cleaning. This was effected before Mr. Chambers's departure. The sunshine recorder supplied to Nagpur had not been set up at the time of Mr. Chambers's inspection.

Jubbulpore and Pachmarhi, the other two observatories of the 2nd class, were inspected by myself. The Jubbulpore observatory was generally in good condition. The sun thermometer, being however defective in action, was withdrawn. The wind-vane had become worn and worked stiffly, and owing to the greasiness of the thread, the hygrometer wet bulb had gone dry.

At Pachmarhi things were less satisfactory. The observer appeared to neglect his duty, and to pay but little attention to the official instructions. The ordinary instruments, with the exception of the sun thermometer, were in fair condition, but the large anemograph was in a state similar to that of Nagpur, having never been cleaned since it was put up. The instrument was taken to pieces during my visit and put into the hands of the regimental armourer for the purpose.

At Seoni, the anemometer wanted cleaning, and a minimum thermometer was not in workable condition, but this last does not imply any neglect on the part of the observer, who is an intelligent, painstaking man, but one who has never had any regular training at a standard observatory.

At Raipur, which had not previously been visited by any officer of the Department, several small matters required remedying; but, in general, the instruments appeared well cared for, and the observer read them accurately.

With the exception of the anemometer and wind-vane, which required cleaning, the state of the Chanda Observatory and the work of the observer were equally satisfactory.

The Khandwa Observatory, which was inspected by Mr. Dallas in January 1886, was found to be in good order; the instruments clean and well exposed. With the exception, that the wind-vane required oiling, the anemometer was rather sheltered by a tree, and that the sun thermometer had been somewhat injured in transport; there was little or nothing requiring to be remedied.

The Hoshangabad Observatory was inspected by myself in November 1885. The wind-vane and anemometer are screened by a large tree to the north-west. The barometer, thermometers and all other instruments were found to be in good condition, but the observer does not always read them correctly.

Special allowances have been awarded to the following Observers in the Central Provinces for the ensuing year :—

Names.	Observatory.	Amount. R
Seetaram	Chanda	5
Pancham	Seoni	5
P. Soobiah	Nagpur	5
Behary Lall Parasar	Khandwa	5
Jadunath Basu	Saugor	5

OBSERVATORIES IN BERAR.—These are the same as in former years—five in number—of which one, at Makhla, is a 4th class observatory, established and carried on by the Forest Department.

All these were visited and inspected by Mr. F. Chambers in 1886. At Amraoti, the thermometer shed was found to be well placed, but the anemometer was on a post only 6 feet high, surrounded by trees and buildings. The barometer was very dirty, as also were certain other instruments, but the observer, though apparently careless, knew how to read his instruments correctly.

At Akola, everything was found in excellent condition as far as depended on the observer. But the barometer and sun thermometer had somewhat deteriorated owing to natural causes, and the observer, although careful and conscientious in his work, appears not to be thoroughly acquainted with the proper mode of performing it.

The Buldana Observatory was removed to a new site at the civil hospital in 1885, and comparative observations are now made at both the old and new sites to determine the difference of their conditions. The barometer had become somewhat dim, but was still in serviceable condition. The thermometers and most of the instruments were in good order, and the observer knew how to read his instruments correctly.

At Chikalda, the wind-vane and anemometer were found to be in a bad position, and the sun-dial was not correctly set in azimuth. Except that the barometer cistern had become somewhat dim, the instruments generally were in excellent condition, and the observer is reported to be intelligent and to read his instruments accurately.

Makhla is an observatory in the forest, surrounded by trees, and the wind observations are of little value on this account. The hygrometer was found to be too much enclosed to show the true humidity of the air, but in general the arrangements were fairly satisfactory, and the observer intelligent.

A nominal list of Superintendents and Observers at the Berar stations is given in Appendix C. The following Observers have been re-allotted special allowances during the current year :—

Names.	Observatory.	Amount. R
Samuel Gregory	Akola	10
Hera Lall	Chikalda	5
Bukaram Pandurang	Amraoti	5

OBSERVATORIES IN CENTRAL INDIA AND RAJPUTANA.—These are the same as in previous years, and are enumerated on page 17. The Maharaja's observatory at Jeypore, which is a 1st class observatory, sends its registers to the Reporter for the North-Western Provinces and Oudh.

Of the remaining observatories, those of Nowgong, Sutna, Ajmere and Sambhar are under the Meteorological Reporter for the North-Western Provinces and Oudh. Those of Neemuch, Indore, Mount Abu and Bickaneer, report to the Meteorological Reporter for Western India, and that of Pachpadra, sends its registers direct to the Central Office.

The observatories of Jeypore, Sambhar, Ajmere, Mount Abu, Neemuch and Indore were visited and the Government observatories inspected by Mr. Dallas, 1st Assistant Meteorological Reporter to the Government of India, in December and January.

The Sambhar Observatory was in a somewhat neglected condition; the thermometers dirty and in some cases not acting properly, and the shed in bad repair. The observer's practice was also in some respects erroneous. The barometer was, however, in good condition and properly suspended.

Ajmere Observatory has become much deteriorated in point of exposure, owing to the growth of shrubs and trees round about it, the observatory being situated in the public garden. The thermometers were dirty and the graduations almost obliterated. The anemometer and wind-vane were in good order and the latter correctly set. It has become necessary to remove the observatory to a more open site, and with the permission of the Principal, Major Loch, it will be moved to the Mayo College.

Mount Abu was found to be in good order, and the observer is reported to take great interest in his work. The thermometer shed was rather small, and one or two instruments were old, but otherwise there was little calling for remark.

The Neemuch Observatory was also in very satisfactory condition as far as depended on the observer. The arrangements for recording the wind involved some inconvenience and probable inaccuracy, and these have been since improved.

The Indore Observatory was less satisfactory, the barometer being very dirty and scarcely readable. The thermometer shed and fences were, however, in good order, but the exposure has been somewhat injured by low buildings and large heaps of building materials round three sides of it. Its position too is said to be objectionable, being too much in a hollow to be fairly representative of the climatological conditions of the country around. The wind arrangements are reported as unsatisfactory, which is also the case at many other stations in Western India, where, on principle, a piece of rag has been made to do duty for a vane. The resulting practice is frequently of the most primitive character and involves much guessing.

The observatories at Sutna, Nowgong, Pachpadra and Bickaneer have not been inspected. The first is, however, known to be excellently conducted, and the second is believed to be excellently supervised. The other two are probably in want of inspection, and this will be effected as soon as they are more accessible than at present.

Special allowances have been granted or renewed to the following Observers in Rajputana and Central India:—

Names.	Stations.	Amount. R
Harnath	Sutna	10
Rampershad	Ajmere	5
Trimbak Rao	Indore	5

OBSERVATORIES IN BOMBAY.—These, excepting the Colaba Observatory, are all under the Meterological Reporter for Western India.

Of the four 2nd class observatories, Kurrachee was inspected by myself in January, the others have not been visited during the year. Of the 3rd class observatories the Reporter for Western India visited those of Surat, Rajkot, Malegaon and the voluntary observatory at Baroda, and I inspected those of Jacobabad and Hyderabad.

The Kurrachee Observatory was found to be in admirable condition, everything being clean and in good repair, and the work of observation appeared to be equally satisfactory.

The Surat Observatory is stated to be in a good position for registering the temperature, but too much surrounded by large trees to afford good indications of the wind. The instruments were in good order, except that the barometer had become somewhat be dimmed in the course of years. The observer read all the instruments accurately.

The Baroda Observatory has only recently begun to contribute registers, and little can be said of its work.

Rajkot was inspected in November last. It has not been a satisfactory observatory for some time past, which is explained by the fact that the man appointed as observer got into debt, and eventually ran away to escape from his creditors. His successor is said to have had but little training, and his work was far from satisfactory. He was dismissed at the end of the year under report. It appears from Mr. Chambers's report that the observatory stood in much need of inspection.

The observer at Malegaon is said to be painstaking but inexperienced, and in several respects his practice was faulty, and the instruments improperly dealt with. The majority of the instruments were, however, in good order.

The Jacobabad Observatory was found to be in very good order, and the registers apparently accurate and neatly kept.

At Hyderabad the observatory was removed in June 1885 from the European military hospital to the jail—a site offering in some respects a much better exposure. A new observer took over the duties in January, a short time before the observatory was inspected, and though intelligent and painstaking, he had been but imperfectly trained. Some of the instruments, especially the hygrometers and the anemometer, were not in good order, and the barometer was suspended in a bad light.

Of the remaining observatories in Bombay little is said in Mr. Chambers's report. The Beckley's anemographs at Belgaum and Deesa are said to have worked well throughout the year, and the Casella's anemograph at Poona has been in nearly continuous action, but that at Ratnagiri has been less satisfactory. The work of the majority of the observers has been trustworthy, but Hyderabad (under the former observer), Rajkot and Malegaon are exceptions to this rule.

The following special allowances have been awarded for the present year to Observers in the Bombay Presidency :—

Names.	Observatory.	Amount. R
Mahadev Cuddum	Ratnagiri	10
Ramkrishna K. Karandikar	Deesa	5
Narayen Sakaram	Poona	5
G. W. M. D'Aranjo	Karwar	5
Ramchundra Datta	Belgaum	5
Mingue Fernandez	Kurrachee	5
Shaik Ali	Jacobabad	5

OBSERVATORIES IN MADRAS, MYSORE AND HYDERABAD.—Of the 21 observatories in these provinces enumerated in the list on page 17, all but five, *viz.*, the Madras Observatory and those of Gopalpore, Vizagapatam, Coconada and Calicut, are under the control of Miss Pogson as Meteorological Reporter to the Government of Madras. Twelve of the sixteen have been inspected during the year, *viz.*, eight by Miss Pogson and four by myself.

Bellary, a 2nd class station, was visited by Miss Pogson in October 1885. The observatory had been moved to a new site on the 24th April, and the thermometer shed was therefore nearly new. The instruments were generally in good condition, except that the mercury in the barometer had become slightly oxidized, and all were clean and properly set up. The work is stated to be accurately and carefully performed, but is somewhat tardily sent in.

Trichinopoly, also a 2nd class station, was inspected by Miss Pogson in March 1886. The condition of the observatory was found to be highly satisfactory and most creditable to the Superintendent and Observer. The wind records are temporarily interrupted during the renewal of the staging for the anemometer.

Bangalore was inspected by myself in February 1886, and the chief instruments verified. Everything was found to be in excellent condition, but the barometer had rather a large error, over and above that originally determined. The observer read his instruments correctly, and the registers were neatly kept and brought up to date. As it is probable that the removal of the observatory will soon be absolutely necessary, a site close by was selected, which will involve the least possible disturbance of the existing local conditions.

Coimbatore was inspected by Miss Pogson in August 1885. In June this had been reduced to the same scale as the 3rd class observatories in Northern India, &c., the work and remuneration of the observer both being reduced on the appointment of a new man as observer. The thermometer shed was found to require repair, and the anemometer post and ladder required renewal; in general the instruments were in a satisfactory condition, but the barometer cistern required cleaning, and the wet-bulb thermometer was slightly encrusted. The work of the observer is well reported of.

Cuddapah was inspected by myself in March 1886, and had also been visited by Miss Pogson in October 1885. The instruments were carefully kept, but on verification, the barometer error was found to be larger than that previously determined, and the maximum thermometer had ceased to be self-registering. The sun thermometer also had a portion of the column separated which had not been allowed for. There is no anemometer, and the wind observations are of doubtful value. Also the observer was disregarding the instructions to take his observations according to local time. A staging for the anemometer and wind-vane is now being provided.

The Kurnool Observatory was removed to a better position in the compound of the Collectorate in July 1885, and one of the Collector's clerks appointed observer.

Madura, like Coimbatore, has been reduced to the status of an ordinary 3rd class station, a new observer being appointed after a previous training at Madras. Miss Pogson inspected the observatory in March 1886, and found it and the instruments in a most disgraceful condition of dirt and neglect. The observer seemed to have profited but little by his training, and was performing his work in a most negligent manner.

Mangalore was visited by myself in February 1886, this being the first time that it has been inspected since its establishment. The barometer and thermometers were re-verified, and the former found to have a large unsuspected error. The instruments were well cared for, but the anemometer and wind-vane were not in a good position, and much obstructed, and the thermometer for nocturnal radiation was not in working order.

Masulipatam has been very unsatisfactory, owing apparently to the apathy and negligence of the observer, who had nevertheless been trained at Madras. It has not been inspected, but the registers are full of self-evident inaccuracies, and in other respects the observer has failed to follow the official instructions.

Mercara was visited by myself in February, and the instruments re-verified. Here also a considerable further correction was required to the barometer. The instruments were in creditable condition in general, but the exposure of the wind-vane and anemometer is bad, and the latter was very dirty. The rain-gauge had no internal receiver. The observatory is in course of removal to a site at the dispensary, offering many advantages over the present site at the Electric Telegraph Office.

Negapatam was inspected by Miss Pogson in March 1886, and found to be in very good condition, except that some of the thermometers were improperly suspended. The work of the observer is also well spoken of.

Salem was inspected, also by Miss Pogson, in August 1885. She reports that the general condition of the observatory reflects great credit upon the Superintendent and Observer.

And finally Wellington was inspected in the same month, and everything found to be in good condition, except that the barometer was suspended in a badly-lighted room, used also for other purposes, not quite compatible with the safety of the instrument.

The remaining observatories have not been inspected during the year, but are considered to be working satisfactorily.

A special allowance has been granted to:—

Name.	Observatory.	Amount. R
C. S. Saminatha Pillai	Coimbatore	5

OBSERVATORIES IN BURMA.—As in the previous year, these are eight in number, including Akyab, which is under the administration of the Meteorological Reporter for Bengal, and Diamond Island, which is under the Central Office. The remainder are under the Sanitary Commissioner for Burma.

The six observatories have all been inspected by the Sanitary Commissioner. Some of them twice or oftener, but not by any officer of the Meteorological Department during the past year. The Rangoon Observatory, which, as a 2nd class observatory, ought to set an example to the province, is the subject of the single disparaging remark in the report, and this observatory has never been equal to most of those of its class. There has been an appreciable improvement in several of the 3rd class observatories, more especially Bassein, Toungoo and Thyetmyo, and special allowances for the present year have been awarded to the following Observers:—

Names.	Observatory.	Amounts. R
T. H. Hilbert	Moulmein	5
Maung Pe	Bassein	5
Shaik Hydiat Ally	Toungoo	5

Mr. Pedler reports a considerable improvement in the Akyab registers, which have been punctually submitted.

OBSERVATORIES AT THE BAY ISLANDS.—These observatories have worked satisfactorily, but no special report has been received on their working and condition. Mr. Peters, who has long acted as Observer at Port Blair, in a most satisfactory manner, left in November last, and has been succeeded by Mr. Carroll. There has been a succession of Observers at Nancowry—a state of things by no means conducive to the satisfactory performance of the work, but apparently unavoidable at this unhealthy station. They are enumerated in Appendix C.

EXTRA INDIAN OBSERVATORIES.—There are now but six of these, since the observatories of the Seychelles and Zanzibar ceased to contribute registers. Another, Aden, has now become somewhat irregular, and several months have elapsed since any register was received. The Leh Observatory has been in admirable working order up to October last, when the Actinometric Observer Sergeant Rowland and his Assistant quitted Leh. Since that time, it appears, difficulties have arisen, and it has recently been reported that, if the work is to be carried on satisfactorily, it will be necessary to send a trained man to Leh as observer. There is, and always must be, great difficulty in keeping an observatory in good working order, on the present system of small allowances, unless the position is one readily accessible to inspection.

The Observatory at Bushire has on the whole worked fairly, but recently some of the observations have been less trustworthy.

The work of the Katmandu Observatory has been resumed in full.

The Observatory at Quetta was inspected, for the first time since its establishment, by myself in January last. It was found to be in admirable order, and the observer, an intelligent and painstaking native of Madras, was performing his work in a manner which left nothing to be desired. This satisfactory state of things is entirely due to the careful supervision of Dr. Fullerton, the Residency Surgeon, who has long been in charge of the observatory.

The Amini Divi Observatory was re-established in May, when the Medical Officer, who is also observer, returned to the station. Since that time the registers have been regularly sent in. It is as yet premature to pronounce on the character of the work.

INSTRUMENTS.

In Appendix D is given a return of the instruments in store at the beginning of the year, and of those received and issued by the Calcutta Meteorological Office, and includes the stock, receipts, and issues of the Alipore Observatory; and in Appendix E is a return of the instruments issued to each observatory. In this are incorporated the returns furnished by the local Reporters.

METEOROLOGICAL OFFICERS AND OFFICE WORK.

The general administration of the meteorological observatories and offices in the different provinces, with the local exceptions noticed in the foregoing sections, has been in the hands of the following officers during the year:—

Name.	Office.	Province.
H. F. Blanford, F.R.S.	Meteorological Reporter to the Government of India	Central Office.
W. L. Dallas, Esq.	Assistant Meteorological Reporter to the Government of India	
Lala Ruchi Ram Sahni, M.A.	2nd Assistant Meteorological Reporter to the Government of India	
A. Pedler, Esq. (Offg.)	Meteorological Reporter to the Government of Bengal.	Bengal and Assam.
S. A. Hill, B. Sc.	Meteorological Reporter to the Government of the North-Western Provinces and Oudh.	N.-W. Provinces, Oudh, Rajputana, and Central India (part.)
Dr. E. Lawrie	Meteorological Reporter to the Government of the Punjab.	Punjab.
J. C. Oman, Esq.		
W. L. Dallas, Esq.		

Name.	Office.	Province.
F. Chambers, Esq.	Meteorological Reporter for Western India	Bombay, Berar, Rajputana and Central India, (part.)
Miss Isis Pogson	Meteorological Reporter to the Government of Madras.	Madras, Mysore, Coorg, and Hyderabad.
Dr. J. H. Loch	Sanitary Commissioner, Central Provinces	Central Provinces.
Dr. C. Little	Sanitary Commissioner, Berar	Berar.
Dr. D. Sinclair	Sanitary Commissioner, Burma	Burma.
Surgeon-Major W. N. Keefer	Senior Medical Officer, Bay Settlements	Andamans and Nicobars.

With the exception of the Punjab and also of Bengal, where, during Mr. J. Eliot's absence on furlough, Mr. A. Pedler has continued to officiate as Meteorological Reporter, the local Reporter's duties have all been performed by the permanent incumbents of the several offices.

In the Punjab, Dr. Lawrie resigned the office of Meteorological Reporter to the Punjab Government on quitting the province in April 1885. After his departure, the office was temporarily held by Mr. Oman of the Punjab Educational Department, who remained in charge until the 1st December. On that date he was relieved by Mr. W. L. Dallas, 1st Assistant to the Meteorological Reporter to the Government of India, who undertook the duties in addition to those of his previous office (a part of which, however, had been meanwhile transferred to the 2nd Assistant Lala Ruchi Ram Sahni.)

Mr. Dallas was absent on privilege leave from the 31st March to the 28th June 1885.

The 2nd Assistant Lalla Ruchi Ram Sahni, M.A., was appointed to that office on the 1st June 1885, after a probationary course in the department. He has since continued to prepare the daily weather reports and the daily weather charts, and during Mr. Dallas's absence from Simla, when inspecting observatories in the cold weather, he was left in independent charge of the Simla office.

The following table shows the number of stations, the registers of which were sent to each of the Reporters, respectively, for reduction and verification during the year under report :—

PROVINCES.	METEOROLOGICAL REPORTERS.						TOTAL.
	India.	Bengal.	North-Western Provinces and Oudh.	Punjab.	Western India.	Madras.	
Bengal and Assam	4	20	...	...	...	...	24
North-Western Provinces and Oudh	1	...	14	...	...	...	15
Punjab	2	...	...	11	...	...	13
Rajputana and Central India	1	...	4	...	4	...	9
Central Provinces	11	...	...	...	...	...	11
Berar	1	...	...	...	4	...	5
Bombay	...	...	...	...	13	...	13
Madras, Mysore and Coorg	1	1	...	...	...	16	18
Burma	7	1	...	...	...	...	8
Bay Islands	2	...	...	...	...	...	2
Extra Indian	5	...	...	...	...	1	6
TOTAL	35	22	18	11	21	17	124

This list does not include the registers of the provincial observatories in Bengal, nor those of Colaba Observatory, Madras, Goa and of Jeypore, which are furnished to the Meteorological Office with all the necessary reductions.

In Bengal, the North-Western Provinces and Bombay (in part) the Reporters superintend the rainfall registers of the district and sub-divisional stations of their respective provinces and prepare weekly and monthly returns of the rainfall.

In Bengal the number of rainfall stations has been increased by 72 during the past year. New rules for registering the rainfall have been drawn up and translated into the native languages, and statistics have been collected respecting the kind of gauges in use at sub-divisional stations, their position, &c., and the proximity of objects likely to interfere with the accuracy of the record. By this means certain cases have been brought to light, in which the exposure of the instrument was decidedly faulty, and these have been remedied.

The number of rainfall stations dealt with by each of the above officers is as follow:—

	Stations.
Bengal	244
North-Western Provinces and Oudh	253
Bombay	477

In the Punjab, the superintendence and collection of rainfall registers are not at present in the hands of the Meteorological Reporter, but Mr. Dallas reports that the subject is under the consideration of the local Government.

In Madras also, it has been proposed to transfer the charge of the rainfall registration to the Meteorological Reporter for the province, but this has not yet been carried out.

The Reporters for Bengal and Western India administer a system of storm warnings for the protection of the local ports. In the case of the former, this duty has hitherto been restricted to the port of Calcutta, signals being exhibited at certain stations on the Hooghly estuary, more especially for warning vessels about to put to sea. Lately, as has been already noticed in Part I of this report, the system has been extended so as to comprehend all the principal ports of the Bay of Bengal.

The meteorological observations copied from the log-books of ships entering the port of Calcutta are now received and tabulated in the Central Office, Calcutta.

Mr. Dallas having been relieved of the work of preparing the daily weather report and chart, now discharges the duties of the Meteorological Reporter for the Punjab. He has continued the reduction and preparation for publication of the marine observations relating to the North Indian Ocean and the Bay of Bengal, received in 1877 and 1880 from the London Meteorological Office. The barometric wind and current charts, with a descriptive text, are now being printed, and will be shortly issued; and considerable progress has been made with the corresponding series for the Arabian Sea.

OFFICE ESTABLISHMENTS.—The following is a return of the numbers of ministerial officers and menials in the offices of the several Meteorological Reporters :—

	INDIA.		Bengal.	North-Western Provinces.	Punjab.	Western India.	Madras.	TOTAL.
	Calcutta.	Simla.						
Head Clerks	1	...	1	1	1	1	1	6
Computers	3	...	...	...	...	...	...	3
Clerks and copyists	5	...	2	1	3	...	4	15
Tabulators	14[1]	6	9	4	...	8	...	41
Draughtsmen	2[2]	1	1	...	...	...	...	4
Artisans	...	...	3	...	...	...	...	3
Peons and menials	7	5	5	2	2	2	2	25

In December last, Government sanctioned a scheme, submitted in the early part of the year under report, for improving the pecuniary prospects of certain of the ministerial officers, and for placing them on a more equal footing; and also for strengthening the Central Office and those of the Punjab, Western India and Madras Reporters. The net increase of expenditure, thus incurred, amounted to R4,000 per annum, and a further sum of R5,963 was provided by savings on the salary of the Punjab Reportership (after providing for the salary of the 2nd Assistant above mentioned) and also on the travelling expenses and special Simla allowances previously incurred for the portion of the Central Office previously transferred annually to Simla and back again.

Babu Fanindra Mohun Basu has continued in charge of the Central Office in Calcutta with the same excellent results as in previous years, and I have had much satisfaction in obtaining for him the increase to his salary included in the above scheme. The Head Computer, Babu Nirduksha Kumar Ghosh, has also worked with great intelligence and zeal, and well merits the increase of his salary, which, in common with the other computers, he has recently obtained.

Mr. Pedler (Bengal) reports that his office has worked exceedingly well under the able superintendence of Babu Chandi Charan Chatterjee, and Mr. Hill (North-Western Provinces and Oudh) reports generally that the clerks and tabulators have all worked steadily and well during the year, under the Head Clerk Babu Chintamony Ghosh. Of the establishment of the Madras Office, Miss Pogson reports that each assistant has worked accurately and diligently throughout the year.

WEATHER BULLETINS AND STORM-SIGNAL SERVICE.—Since the 8th April 1885, the daily weather reports issued under the authority of the Department of Revenue and Agriculture, have been drawn up at Simla, a permanent establishment being retained there for the purpose. The reports are issued in the same form as in the previous year. The verbal summary, which accompanies each issue, is telegraphed to all the Provincial Governments, and copies are furnished to the daily newspapers at Calcutta, Allahabad and Bombay;

---

[1] Besides these, there are three temporary clerks for reducing the London Meteorological Office marine logs.

[2] Besides these, there is one temporary draughtsman for drawing up the marine charts.

295 copies of the printed report are issued daily to Government officers and one to a subscriber.

As a part of the work connected with the daily reports, notice is sent by urgent telegram to the Meteorological Office, Bombay, of the progress of any storms that advance from the Bay of Bengal towards the Western Presidency; and notice by urgent telegram is sent to the Civil and Political Officers of Khandesh and Guzerat of the appearance of storms likely to produce floods in the Tapti and Nerbuda; arrangements have been made also for telegraphing direct to the same officers, from certain observatories in the upper drainage basins of these rivers, the occurrence of heavy rain, in order to give them due warning of probable floods.

In Bengal, the Daily Weather Report for the province was issued from the 20th April to the 7th November, and the Bay of Bengal Weather Report illustrated by a chart, throughout the year. The latter was issued to 39 Government officers and 22 subscribers, the former to 99 Government officers and 19 subscribers.

The storm signals were hoisted on three occasions during the year, *viz.*, for the False Point cyclone of the 22nd September, for a storm which reached the Sunderbuns on the 14th and 15th October, and for that of the 14th to the 23rd November. This storm was formed off the coast of Ceylon and tracked, day by day, in the Bengal Weather charts, as it moved up the Bay, finally crossing the Arakan coast south of Chittagong and breaking up among the Arakan hills. There has been no previous instance of a storm being followed up the Bay with such precision, and indeed it is a rare case that any storm follows so long a course, at so leisurely a rate of progress, and in such a direction (north-east) as this.

At stations on the Bombay coast, the signals were hoisted only on one occasion during the year, *viz.*, for the little storm of the 8th to 10th June, which appears to have originated in the south of the Peninsula, and not as has usually been the case, on the Bay of Bengal. It was very small and the barometric disturbance slight.

WEEKLY, MONTHLY AND SEMI-ANNUAL REPORTS.—From May to October, a descriptive summary of the weather is prepared monthly; during the rest of the year every alternate month; and published in the *Gazette*. Reports on the winter and spring snowfall were also drawn up in May and June, and a forecast of the character of the rains was attempted, which has been noticed at length in Part I of this report.

Charts of the rainfall for the three seasons, into which the year has been divided for this purpose (the cold season, the hot season, and the rains) have been prepared for 1885 from the rainfall registers received by post, and several copies furnished to Government, but these are not published. A general chart and tabular return of the rainfall of the year was also prepared for the Secretary of State.

In Bengal, weekly and monthly Meteorological and Rainfall Reports, for the province, are published in the *Calcutta Gazette*, and sets of 3 rainfall charts, showing the actual distribution of the rainfall and its variation from the average, 1st, in absolute measurement and 2nd as a percentage of the normal average, are prepared monthly for Government. A general summary of the weather of the monsoon and the distribution of the rains, in Bengal, was also drawn up for the Government of Bengal.

In the North-Western Provinces and Bombay, monthly abstracts of the registers of the several observatories are published in the local *Gazettes*, and in the Punjab, since the beginning of 1886, a descriptive summary of the weather of the province has been prepared for Government and published in like manner.

ANNUAL REPORTS.—The report on the meteorology of the year 1884 was complete and in the printer's hands by the beginning of December 1885, and the printed report submitted to Government on the 23rd March 1886.

The report gives tables of temperature for 138 stations, and rainfall returns for 478 stations, being an increase of four of the former and sixteen of the latter on the numbers respectively given in the report for 1883. The returns of most other meteorological elements are nearly as numerous as those of temperature. The elements tabulated in the Appendix are as follow. For comparison I give the corresponding number for the four previous years :—

	NUMBER OF STATIONS.				
	1880.	1881.	1882.	1883.	1884.
Equilibrium temperature of solar radiation	109	106	112	111	113
Duration of bright sunshine	...	...	...	2	3
Temperatures of nocturnal radiation	108	106	104	107	106
Temperatures of the ground	2	4	4	4	4
Mean and extreme air temperatures	126	131	130	134	138
Sea-level equivalents of mean temperatures	105	108	108	111	112
Means and extremes of atmospheric pressure	122	251	124	125	127
Sea-level equivalents of mean atmospheric pressure	105	107	108	109	110
Direction and movement of winds	124	127	125	127	128
Temperature of evaporation	115	121	120	124	128
Tension of atmospheric vapour	123	128	127	130	135
Mean relative humidity	123	128	127	130	135
Mean proportion of clouded sky	122	125	124	127	130
Inches of rainfall in each month	399	417	457	462	478
Number of days on which rainfall was measured	379	403	457	462	474

The descriptive letter-press discusses the chief characteristics of the meteorology of the year. It includes tables of the average values of all the more important meteorological elements, for all stations that have furnished returns for three years and upwards, and the report is illustrated with four plates, *viz.*, a chart showing the position of all observatories and rain-gauge stations, and three in coloured lithography, representing the mean distribution of temperature, pressure, and winds in each month of the year.

The original observations of six observatories, *viz.*, Calcutta, Lucknow, Lahore, Nagpur, Bombay and Madras, were issued in a distinct publication in monthly parts. Those forming the volume for 1885 were completed in June 1886.

The Reporters for Bengal, the North-Western Provinces, the Punjab, and Bombay, each prepared and submitted to the local Governments, summaries of the weather features of the year 1884 in their respective provinces.

MISCELLANEOUS PUBLICATIONS.—Parts IV and V of Volume II of the Indian Meteorological Memoirs were issued during the year, completing the second volume of the work. The first, already referred to in last year's report, contains a very important and elaborate discussion of the characters and tracks of all the storms of the Bay of Bengal, that have been recorded on the office charts, during the months May to December, in the five years 1877 to 1881. The second contains a short Memoir of Mr. Hill's on the variations of the temperature and humidity of the atmosphere at 4 and 40 feet above the ground surface at Alipore. Also the title page, lists of contents and general index to the volume.

Part I of Volume III was issued just before the close of the year, containing the first part of a Memoir on the rainfall of India, which, when complete, with its tables, will occupy the whole volume. Three other Memoirs, *viz.*, one by Mr. Eliot on the Akyab cyclone of the 12th to 17th May 1884, one by myself on the diurnal variation of the rainfall of Calcutta, and one by Mr. Dallas on the meteorolegy of a sea tract to the south of the Bay of Bengal, were printed and nearly ready for issue at the close of the year, forming Part I of Volume IV.

Other Memoirs are in course of preparation by Mr. Hill, Mr. Pedler and myself. Mr. Chambers, on the plea of want of sufficient office assistance, has contributed nothing to the official publications of the department since the list of storms drawn up in 1882, and published in Part I, Volume II of the Memoirs.

Appendix F, gives a list of the Government officials, libraries, observatories, societies, &c., to which the publications of the office are presented, including those which send their own publications in exchange.

LIBRARY.

The additions to the library during the past year are enumerated in Appendix G, under 215 titles. The library remains, as last year, in ten double book-cases in a large room on the ground floor of the office building. It is in good order, but it has not been practicable to undertake its re-arrangement, no officer having been available for the purpose.

HENRY F. BLANFORD,

Meteorological Reporter to the Government of India.

SIMLA:

The 28th July 1886.

APPENDIX A.

Extract from the Administration Report of the Meteorological Reporter to the Government of Bengal.

* * * * * * *

Both the second class observatories were visited during the year. *Dhubri* was inspected by myself on 19th March 1886. Generally speaking, I was far from satisfied with the condition of the observatory. The Casella's anemograph was, so far as [regards] direction, working with considerable friction, and the pointer was showing south-south-west, but in reality the wind was east-north-east. It showed a great want of observation on the part of the observer to record and report a wind direction almost diametrically opposite to the actual direction. The thermometers were dirty and covered with cobwebs. The bulbs of the wet instruments were found to be slightly encrusted, and the compound of the observatory was considerably overgrown with jungle. The solar radiation thermometer had a separation of mercury at the top of the tube of almost exactly 4°. The observer stated that he made allowance for the break, and that he had reported the fact to the head office, but the statement could not be verified from the office records either at the observatory or at the head office. The rain-gauge receiver was found to hold only 1·38 inches of rain, and the observer stated that if the reservoir overflowed, he mopped up the excess water with a cloth and squeezed out the water into the measuring glass. The rain-gauge was therefore changed for a 5-inch gauge with a proper receiver. The anemometer was in very bad order with the cups dented, and the instrument was erected in a most disgraceful manner. A new anemometer has been supplied. The observer and his assistant do not appear to understand their work properly. The observer's knowledge of English is very limited, and he is not in my opinion competent for the post of senior observer, though he might perhaps have previously done his work as assistant overseer properly. A new head observer will have to be appointed after a man is thoroughly trained in the Alipore Observatory. By my visit to the station, my former convictions of the carelessness of the observer were fully confirmed. In July 1885, I had occasion to fine the head observer Kadimuddin Ahmed R5, and his assistant his allowance for nine days, for neglect of duty in missing the hourly observations on several days, but the fines scarcely seem to have had the desired effect.

Saugor Island was visited by my head clerk on the 12th January 1886. It was the first visit of inspection since the thermometer shed was erected and the Beckley's anemograph put up in position in 1880. The sites for the shed and the anemograph were selected by Mr. Eliot on his visit to the station in March 1878. The thermometer shed is of the standard pattern and is erected within the grounds of the telegraph office, and enclosed by a nulla and a mound of earth at a distance as a protection from inundation. The telegraph office building stands directly to the south or south-east of the shed at a distance of 38 feet from it. There are several trees very near to the shed, which have the effect of making the place very close and shady. The barometer is placed against the wall near the doorway leading into the signal room. It was originally placed in a wooden shed of the old telegraph office, and within the light-house compound, but the instrument has been in its present position since February 1880, in a good light, and at a height of 25·3 feet above the mean sea-level. A Fortin's instrument is in use, and it was found to be in good working order. The thermometers were found in good order.

The sun thermometer continues to be exposed on forked sticks at a height of 6 inches from the ground, as the same instrument has been in use since 1876. The Regulation stand has not been brought into use here. The rain-gauge in use was of old pattern, and 6 inches in diameter. The float of the gauge was lost, and the measurement of rainfall was made by means of a corresponding measure-glass. It was situated on the embankment, towards the south of the telegraph building. A new 5-inch rain-gauge has since been supplied and brought into use. The Beckley's anemograph is set up on the top of the watch tower of the telegraph office, and the cups of the anemometer are 51 feet above the ground. There are no objects near, higher than the building. The instrument appeared to be set correctly, and its bearings were found well oiled. The condition of the observatory in charge of Mr. Peters, telegraph master, who has been for a long time connected with the Department, was highly satisfactory.

During the observership of Mr. Thomas, telegraph master, the grass minimum thermometer readings were found to be very low. An enquiry was made into the matter, and the result showed the defect in the readings was due to a break in the spirit column of the instrument, which was not noticed by the observer for months together. Mr. Thomas was therefore fined R15 in August 1885 for this gross carelessness. The grass readings for 18 months had to be rejected.

Eight of the 3rd class observatories were inspected during the year, *viz.*, Gya, Bankipore, Hazaribagh, Dacca, Darjeeling, Durbhunga, Jessore and Purneah.

Purneah was visited by my head clerk on 23rd June. He reported that the observatory shed had been removed to a new site, near the jail compound, by order of Mr. Eliot, owing to the erection of a building for the jailor's quarters close to the old site, but the conditions of exposure were almost identical with those of the abandoned site. The shed was in good order and the instruments clean and in working order, with the exception of the minimum thermometer, which had its column separated. The anemometer has become much shut in by the gradual growth of a row of high trees, that stand to the east and north-east of the instrument, at a distance of 60 yards. The average height of the trees is now 50 to 60 feet, while the anemometer is at a height of 25 or 26 feet above the ground. The medical officer (Dr. Picachy), in charge of the observatory, has been asked to select a more suitable site for the anemometer.

Darjeeling was visited on 16th November. As previously stated, the object of the inspection was to put the Beckley's anemograph in working order, as it had not worked for nearly two months, and the observer had not been able to put it right. The instrument was rendered effective. The other instruments were in good order, except the minimum thermometer, the column of which had slightly separated. The mercury in the cistern of the barometer was also cleaned, and the instrument put in good order. Mr. R. Carter, Rector, St. Paul's School, who is the Superintendent of the observatory, continues to take much interest in the observatory.

Bankipore was visited on 27th November by myself. The condition of the observatory was fairly satisfactory. Munshi Mohabat Lal, who has been the observer for some time, having been suspended from his appointment as head clerk, Temple Medical School, a brother clerk, who has had experience in meteorological work, has been temporarily put in charge of the observations. A higher rate of allowance had been sanctioned for the station by the recent arrangements in consideration of the fact that Munshi Mohabat Lal would reduce the observations himself and submit completed returns; but if the Munshi is not reinstated, and a new man is permanently appointed, the meteorological allowance will have to be reduced to R15, as at other third class stations, and the work of reduction and tabulation will be done in the central office.

Gya was visited on 16th December by Mr. Blanford, Meteorological Reporter to the Government of India. Mr. Blanford carefully verified the thermometers and the barometer in use, and the corrections of some of the thermometers were found to have altered. These instruments have therefore been recalled for re-verification. The worthlessness of the minimum readings at Gya was noticed in the previous administration reports. The real cause of this anomaly has been found to be that, since the introduction of the Bengal Daily Weather Report in 1883, the readings of the wet minimum thermometer have been reported to this office in the 10 A.M. telegrams instead of those of the dry minimum. The observer (Nowringee Lal) had been given ample opportunity to find out the cause of the erroneous minimum readings reported daily, but he failed to do so and the fact is fatal to his character as an observer. He was consequently fined two months' pay last year, and again a month's allowance (R15) in July 1885 for his continued inattention to the instructions he had received. The observer (Nowringee Lal) has gone on leave for six months, and advantage has been taken of this to appoint Mukund Lal, who had undergone practical training at the Bankipore observatory, to the observership.

Jessore was visited by my head clerk on 27th December. There has been no change in the site or exposure of the instruments, but there had been a very decided change for the worse in the observer, and most of the instruments were in bad order, and the observer's excuses for the state of the observatory were most paltry. In consequence the observer's special allowance has been suspended for six months.

Dacca observatory was visited by my head clerk on 20th January 1886. The barometer has been removed since 3rd May 1884 to the present position in the signal room of the telegraph office. It is now at an elevation of 21·7 feet above mean sea-level. The mercury in the cistern of the barometer was cleaned. The minimum thermometer had been out of order since November, and the observer had been unable to put it right, but the spirit column was easily restored. The anemometer was much in want of oil, and the observer neglected to take in the sun thermometer every night. The observatory was therefore not in very satisfactory order.

Hazaribagh was inspected on 27th March. The condition of the observatory was very satisfactory. All the instruments were found to be in perfectly good order. The point of greatest importance in the inspection was to solve certain discrepancies in the wind records of the Casella's anemograph. It was found that the principle on which the observer had worked hitherto was to make the embossed arrows on the paper correspond to the actual direction of the pointer of the wind-vane or to the absolute direction of the wind, and thus the N. embossed arrow on the paper made a very considerable angle with the line of the paper. The instrument was re-set, and the observer instructed how to keep the instrument in the required order. The observer was recommended for the continuance of the special allowance of R5 he had hitherto drawn.

Durbhunga observatory was inspected on 30th March. All the instruments were in perfectly good working order and the shed in excellent repair. The observer, Baboo Jogin Chunder Banerjee was the recipient of a five-rupee special allowance in 1883-84, but it was withdrawn for bad work. The observer was well reported on in 1884-85, and the condition of the observatory continuing to be equally good during 1885-86, he was restored to the special allowance for the ensuing year.

The remaining observatories of this class, *viz.*, Sibsagar, Cuttack, Chittagong, Berhampore, Silchar, Demagiri, False Point, Akyab, Tura, Tezpore and Burdwan, could not be visited during the year; but from the returns received, it may be presumed that their efficiency has been maintained in the majority of cases.

Sibsagar.—Baboo Dandadhar Dutt Barua has continued to do good work during the year, and the special allowance of R10 has therefore been continued to him during the ensuing year.

Cuttack.—Mr. Alley, telegraph master, was in charge throughout the year. The observations have been satisfactory and the returns punctual. He has been and is still the recipient of a five-rupee special allowance for meritorious services.

Chittagong.—The telegraph master in charge, Mr. Gabriel, has done his work well, and has been in charge of the observatory during the whole of the year. There were very few mistakes in the observations.

Berhampore.—The returns have been regular and satisfactory. Baboo Mahendra Nath Roy continues to be the observer. His special allowance of R10 has therefore been continued to him.

Silchar.—Mr. Blanford, Meteorological Reporter to the Government of India, visited this station early in 1884, and found that the shed was not built according to the standard plan. The observatory has hitherto been a most costly one, requiring yearly repairs, averaging R100. This was due to the shed being much larger than was necessary, and to the sole use of wood in its construction, which was rapidly destroyed by the attacks of white-ants. Mr. Blanford therefore sanctioned the erection of a more durable shed of standard dimensions supported on iron pillars. This has since been completed. The observer has submitted fairly satisfactory returns.

Demagiri.—This station has not been visited since it was started. The only instruments in use are a dry dulb and a maximum, a dry minimum thermometer and a wind-vane. The wind-vane was blown down by a storm and injured. The maximum and minimum thermometer readings have not been satisfactory. The civil hospital assistant of the Police Dispensary was in charge of the readings under the supervision of the civil medical officer. There is no allowance attached to this station, as it was established by the Deputy Commissioner of Chittagong Hill Tracts under the provisions of the rules for volunteer observers. The observations from this station are so far from satisfactory that they are frequently rejected.

False Point.—The observatory shed was blown down by the storm of September 23rd, which passed over this station and swept away Hookitola, which was also a rainfall-recording station. A very valuable set of observations was made at this station during the cyclone of this date by Mr. Workman, the observer. The telegraphic communication remained suspended from the 22nd

September 1885 to 6th January 1886, when the 10 A.M. telegrams were again resumed. The shed instruments were all saved by their timely removal, but the anemometer was blown down and badly injured. This has since been replaced by a new instrument. The records for the year were fairly satisfactory. Mr. Workman, light-house keeper, was formerly the observer on an allowance of R25 a month, but he having been appointed Port Officer, False Point, Mr. London succeeded to the post of meteorological observer on the reduced allowance of R20, and the observations are now being taken by him.

Akyab.—The registers have improved much. They were punctually received in this office.

Burdwan.—The observatory is apparently in excellent order, and the returns from this station have been satisfactory. Baboo Mokshoda Prasad Roy Chowdhury has well maintained his reputation, and has been recommended for the continuance of his special allowance of R10.

Tura.—The registers from this station have been of very doubtful value.

* * * * * * * * *

ALEX. PEDLER,
Offg. Meteorological Reporter to the
Government of Bengal.

METEOROLOGICAL OFFICE, BENGAL;
The 5th June 1886.

APPENDIX B.

Extract from the Administration Report of the Meteorological Reporter to the Government of the North-Western Provinces and Oudh.

The first class observatory at Allahabad obtained its full equipment in the beginning of March, and the full staff of observers has been entertained only since the 1st April. The new building in the Chatham lines, for the observatory in conjunction with the Meteorological Office, was not quite completed at the end of the year under report, but was already so far advanced in November that it could be occupied by the office. Very little progress was made during the cold weather, and it was not until the beginning of March that the arrangements for setting up the meteorograph were completed.

* * * * * * * * *

Whilst the building was being got ready, the series of comparative thermometer readings at the old and new observatory sites, commenced in September 1884, was carried on; but from the 1st December only two complete sets of readings have been made at the old site instead of four as formerly, whereas at the new observatory four sets of observations have been made instead of two. On the removal of the office and the accompanying transformation of the new observatory into the principal one, the hour of the early morning observation was changed from 4 to 6 A.M., the latter being more convenient to the observers and more nearly coincident with the epoch of minimum temperature. It is, moreover, the hour adopted at the Alipore Observatory, Calcutta.

A summary of the comparative observations of temperature and humidity for the year under report is given in the Appendices. The series will be continued until the end of August, when a period of two years will be completed. The twelve months' observations in the Appendix show that the mean temperature at the new site is higher than at the old by about half a degree, and that the difference is greatest at the end of the rains, whilst at the hottest time of the year the old site is slightly hotter than the new. The minimum temperatures do not differ much in any month, nor do the maxima, except in the hot-weather months, when they are about a degree lower at the new site than at the old. The excess of the mean at the new site is due to the higher temperature of the forenoons and afternoons, as indicated by the observations made at 10 A.M. and 4 P.M.

These differences are all explained by the circumstances that the new site is on an open breezy plain, covered in the rainy season with grass cropped short by grazing cattle, whilst the old site is in a hollow surrounded by trees, and in the rains and for some time afterwards, covered with long grass and other vegetation. The trees cut off the morning and afternoon sun, but not the mid-day sun; and as the air does not circulate so freely as at the new site, a higher temperature is attained at the hottest time of the day, in those months when the wind velocity is highest. In the months at the end of the rains, when there is little or no wind, the maximum temperatures would probably be equal were it not that the old site is rendered slightly cooler by the vegetation and consequent evaporation. At this season also, the foliage of the trees is densest and cuts off the morning and afternoon sun most completely.

The humidity observations, on the whole, bear out this explanation, but during the three months of the dry hot weather, there was apparently a slight excess of humidity at the new site, not easily explicable.

The nocturnal radiation thermometer gave uniformly lower indications at the new site than at the old, as was to be expected. The differences of the solar radiation thermometers are so great and irregular that they are only explicable on the assumption that the two instruments (which are supposed to be corrected to a common standard) are not comparable, except when exposed side by side under absolutely identical conditions. That a very slight change of position alters the indications of these instruments, owing to a change in the quantity of heat they receive from surrounding objects, has been recently and unexpectedly rendered evident, by the inadvertent vitiation of the long series of observations made with the instrument in use at the old site, which has fortunately escaped breakage since January 1876. In 1884, the position of this instrument was changed, to make room for the tower mentioned in last year's report—a change which I did not discover until this year. The instrument was placed 3 or 4 yards nearer to a small mango tree, the result being a permanent rise of its indications empirically determined to be about 2° Fahrenheit. As the long series of observations at the old site has thus been interrupted, and the observations were certain to be discontinued at the end of August, the instrument has now been removed to the new observatory, where it will again be compared with the one in use there.

* * * * * * * * *

Since the removal of the Meteorological Office and the observatory head-quarters to the new building last November, the hourly observations kept up, as at the second class stations, for nearly ten years, have been abandoned. The observations, now made, comprise a full set of pressure, temperature, humidity, wind, rain, cloud, and general weather observations five times daily, besides the continuous registration of the first five of these elements by the Van Rysselberghe meteorograph; also observations of ground temperature, and of the temperature and humidity in the thermograph penthouse and in a similar penthouse near the top of the tower three times a day, these latter being made with a view to determine the variation of temperature and humidity with height above the ground; and, in addition to all the above, observations of special instruments, such as the sunshine recorder, the nephescope, and Frankland's solar thermometer.

S A. HILL,

Meteorological Reporter to the Government,
North-Western Provinces and Oudh.

Comparison of shade temperatures at the New Observatory, Chatham Lines, Allahabad, with those simultaneously recorded at the old site.

MONTH.	MEAN TEMPERATURE.*			MEAN AT 10 A.M.			MEAN AT 4 P.M.			MEAN MAXIMA.			MEAN MINIMA.			MEAN DAILY RANGE.		
	New.	Old.	Difference.	New.	Old.	Difference.	New.	Old.	Difference.	New.	Old.	Difference.	New.	Old.	Difference.	New.	Old.	Difference.
April 1885	86·1	85·9	+0·2	92·0	92·9	—0·9	99·3	99·0	+0·3	101·1	102·0	—0·9	71·9	71·6	+0·3	29·2	30·4	—1·2
May ,,	88·6	88·7	—0·1	93·9	94·8	—0·9	101·1	100·9	+0·2	102·5	103·8	—1·3	74·9	75·0	—0·1	27·6	28·8	—1·2
June ,,	92·0	92·6	—0·6	95·1	95·7	—0·6	100·0	100·2	—0·2	102·2	103·4	—1·2	82·9	83·0	—0·1	19·4	20·4	—1·0
July ,,	84·4	84·3	+0·1	85·7	85·7	0·0	89·0	88·4	+0·6	90·8	91·0	—0·2	79·1	79·3	—0·2	11·7	11·7	·0
August ,,	81·6	81·3	+0·3	83·4	83·1	+0·3	84·7	84·2	+0·5	87·1	87·4	—0·3	77·8	77·6	+0·2	9·3	9·8	—0·5
September ,,	83·0	82·4	+0·6	87·0	86·4	+0·6	90·0	88·7	+1·3	92·0	92·0	·0	76·1	75·8	+0·3	15·9	16·2	—0·3
October ,,	78·2	76·9	+1·3	84·8	82·9	+1·9	91·5	88·2	+3·3	92·6	91·8	+0·8	66·4	66·3	+0·1	26·2	25·5	+0·7
November ,,	68·3	66·7	+1·6	77·6	74·0	+3·6	83·8	80·2	+3·6	84·7	84·3	+0·4	54·0	54·1	—0·1	30·7	30·2	+0·5
December ,,	59·8	59·1	+0·7	63·9	62·6	+1·3	69·9	68·6	+1·3	71·4	70·9	+0·5	50·2	50·8	—0·6	21·2	20·1	+1·1
January 1886	59·9	59·1	+0·8	64·6	62·5	+2·1	72·4	70·9	+1·5	73·6	73·0	+0·6	48·1	48·3	—0·2	25·6	24·7	+0·9
February ,,	62·9	62·5	+0·4	67·3	66·2	+1·1	77·8	77·1	+0·7	78·6	78·9	—0·3	49·4	49·5	—0·1	29·2	29·5	—0·3
March ,,	76·1	75·4	+0·7	81·5	80·7	+0·8	88·8	88·3	+0·5	90·3	91·0	—0·7	63·0	62·4	+0·6	27·3	28·6	—1·3
YEAR	76·7	76·2	+0·5	81·4	80·6	+0·8	87·4	86·3	+1·1	88·9	89·1	—0·2	66·1	66·1	·0	22·8	23·0	—0·2

* Computed by means of variable corrections proportional to the range, from the 10 A.M., 4 P.M., maximum and minimum observations.

Comparison of the readings of the radiation thermometers taken at the Old and New Observatories, Allahabad.

Month.		Sun radiation thermometer.			Nocturnal radiation thermometer.		
		New.	Old.	Difference.	New.	Old.	Difference.
April	1885	162·1	162·3	—0·2	60·3	62·0	—1·7
May	„	163·7	163·6	+0·1	64·2	66·8	—2·6
June	„	162·5	160·9	+1·6	76·5	77·8	—1·3
July	„	149·4	145·3	+4·1	77·0	77·4	—0·4
August	„	146·4	140·2	+6·2	76·1	76·2	—0·1
September	„	153·0	152·2	+0·8	71·9	71·9	·0
October	„	152·4	152·3	+0·1	57·8	58·8	—1·0
November	„	143·8	146·4	—2·6	43·6	45·0	—1·4
December	„	124·2	125·3	—1·1	41·4	43·4	—2·0
January	1886	133·4	135·4	—2·0	37·8	39·6	—1·8
February	„	144·1	140·9	+3·2	37·8	40·3	—2·5
March	„	156·3	152·6	+3·7	52·5	55·0	—2·5
	Year	149·3	148·1	+1·2	58·1	59·5	—1·4

Comparative observations of atmospheric humidity at the Old and New Observatories, Allahabad.

Month.		Vapour tension in inches of mercury.						Relative humidity or percentage of saturation.					
		Mean.			At 10 a.m.			Mean.			At 10 a.m.		
		New.	Old.	Difference.	New.	Old.	Difference.	New.	Old.	Difference.	New.	Old.	Difference.
April	1885	·388*	·373*	+·015	·411	·384	+·027	33*	32*	+1	28	26	+2
May	„	·488	·458	+·030	·509	·477	+·032	39	37	+2	34	31	+3
June	„	·747	·722	+·025	·756	·736	+·020	53	51	+2	49	47	+2
July	„	·944	·974	—·030	·970	·999	—·029	79	83	—4	79	81	—2
August	„	·932	·954	—·022	·941	·967	—·026	86	88	—2	82	85	—3
September	„	·851	·871	—·020	·893	·904	—·011	74	77	—3	70	72	—2
October	„	·559	·615	—·056	·601	·620	—·019	57	64	—7	50	55	—5
November	„	·375	·398	—·023	·405	·392	+·013	54	60	—6	45	47	—2
December	„	·376	·389	—·013	·394	·392	+·002	72	75	—3	67	69	—2
January	1886	·351	·359	—·008	·380	·366	+·014	66	70	—4	62	64	—2
February	„	·256	·308	—·052	·264	·294	—·030	45	54	—9	39	45	—6
March	„	·428	·454	—·026	·455	·481	—·026	49	53	—4	43	46	—3
	Year	·558	·573	—·015	·582	·584	—·002	59	62	—3	54	56	—2

* Crude mean of 10 A.M. and 4 P.M. and minimum observations.

APPENDIX C.

List showing the names of the Superintendents and Observers at the Meteorological Observatories in India, during the year 1885-86.

PROVINCE.	Observatory.	Class.	Names of Superintendents.	PERIOD.		Names of Observers.	PERIOD.	
				From	To		From	To
BENGAL AND ASSAM.	Sibsagar	Third	Civil Surgeon	1st April 1885	31st Mar. 1886	Dandadhar Dutt, Burua	1st April 1885	31st Mar. 1886.
	Dhubri	Second	Dr. Edwin Dobson	1st April 1885	31st Mar. 1886	Munshi Kadimuddin Ahmed	1st April 1885	31st Mar. 1886.
						Ambica Prosad Dey (*Assistant*)	1st April 1885	16th April 1885.
						Munshi Kafayat Ulla (*Do.*)	26th April 1885	31st Mar. 1886.
	Silchar	Third	Civil Surgeon	1st April 1885	31st Mar. 1886	Romesh Chundra Bhadra	1st April 1885	31st Mar. 1886.
	Tezpore	Ditto	Ditto	2nd April 1885	31st Mar. 1886	Joggeshwar Dass	2nd April 1885	6th Nov. 1885.
							19th Mar. 1886	31st Mar. 1886.
						Narayan Chandra Basu	6th Jan. 1886	18th Mar. 1886.
						Shufget Hossain	7th Nov. 1885	5th Jan. 1886.
	Patna	Ditto	Ditto	1st April 1885	31st Mar. 1886	Munshi Mohabat Lall	1st April 1885	27th Jan. 1886.
						Surjan Singh	28th Jan. 1886	31st Mar. 1886.
	Hazaribagh	Ditto	Ditto	1st April 1885	31st Mar. 1886	Nuthoo Lall	1st April 1885	31st Mar. 1886.
	Saugor Island	Second	......	......	......	Mr. J. A. Thomas	1st April 1885	17th Sept. 1885.
						,, W. Cahill	18th Sept. 1885	14th Nov. 1885.
						,, R. H. Peters	15th Nov. 1885	31st Mar. 1886.
	Cuttack	Third	......	......	......	,, H. W. Alley	1st April 1885	31st Mar. 1886.
	Chittagong	Ditto	......	......	......	,, J. E. Gabriel	1st April 1885	31st Mar. 1886.
	Darjeeling	Ditto	Rector, St. Paul's School.	1st April 1885	31st Mar. 1886	,, W. Moore	1st April 1885	31st Mar. 1886.
	Purneah	Ditto	Civil Medical Officer	1st April 1885	31st Mar. 1886	Rajoni Kanta Chuckerbutty	1st April 1885	17th July 1885.
						Matilal Roy	18th July 1885	27th Dec. 1885.
						Lalit Mohun Banerjee	28th Dec. 1885	31st Mar. 1886.
	Durbhanga	Ditto	Civil Surgeon	1st April 1885	31st Mar. 1886	Jogin Chunder Banerjee	1st April 1885	31st Mar. 1886.
	Gya	Ditto	Ditto	1st April 1885	31st Mar. 1886	Nowringee Lall	1st April 1885	31st Dec. 1885.
						Mukund Lall	1st Jan. 1886	31st Mar. 1886.

List showing the names of the Superintendents and Observers at the Meteorological Observatories in India, during the year 1885-86—continued.

PROVINCE.	Observatory.	Class.	Names of Superintendents.	PERIOD		Names of Observers.	PERIOD	
				From	To		From	To
BENGAL AND ASSAM—*concld.*	Berhampore	Third	Civil Surgeon	1st April 1885	31st Mar. 1886	Mohendra Nath Roy	1st April 1885	31st Mar. 1886.
	Burdwan	Ditto	Ditto	1st April 1885	31st Mar. 1886	Mokhoda Prasad Chowdhury	1st April 1885	31st Mar. 1886.
	Jessore	Ditto	Ditto	1st April 1885	31st Mar. 1886	Paresh Nath Roy Chowdhury	1st April 1885	31st Mar. 1886.
	Dacca	Ditto	......	......	......	Mr. T. W. DeSouza	1st April 1885	31st Mar. 1886.
	False Point	Ditto	......	......	......	Mr. E. Workman	1st April 1885	23rd Sept. 1885.
						,, J. London	24th Sept. 1885	31st Mar. 1886.
	Demagiri	Fourth	Civil Medical Officer	1st April 1885	31st Mar. 1886	Grish Chundra Bhar	1st April 1885	18th April 1885.
							26th May 1885	31st Mar. 1886.
						Rajany Kanta Bose	19th April 1885	25th May 1885.
	Mongpoo	Ditto	......	......	......	Mr. George A. Gammie	1st April 1885	31st Mar. 1886.
	Tura	Ditto	Civil Medical Officer	1st April 1885	31st Mar. 1886	Abdul Majeem	1st April 1885	31st Mar. 1886.
	Pedong	Third	......	......	......	Revd. Father A. Disgodins, S.J.	1st April 1885	22nd Mar. 1886.
						,, ,, Hervagault, S.J.	23rd Mar. 1886	31st Mar. 1886.
N.-W. PROVINCES AND OUDH.	Allahabad	First	S. A. Hill, Esq., B.Sc.	1st April 1885	31st Mar. 1886	Kedar Nath Chatterjee	1st April 1885	31st Mar. 1886.
						Sosibhusan Banerjee (*Asst.*)	1st April 1885	31st May 1885.
						Nand Lal (*Asst.*)	1st June 1885	30th June 1885.
						Makham Lal Mukerjee (*Asst.*)	1st July 1885	31st July 1885.
						Nand Lal (*Asst.*)	1st Aug. 1885	31st Dec. 1885.
						Sosibhusan Banerjee (*Asst.*)	1st Jan. 1886	31st Mar. 1886.
	Agra	Third	Dr. A. H. Hilson	1st April 1885	27th Aug. 1885	Mir Altaf Ali	1st April 1885	31st Mar. 1886.
			,, W. Moir	28th Aug. 1885	26th Feb. 1886	Abdul Majid Khan (*Asst.*)	1st April 1885	31st Dec. 1885.
			,, A. H. Hilson	27th Feb. 1886	31st Mar. 1886			
	Lucknow	Ditto	,, J. C. Whishaw	1st April 1885	15th Feb. 1886	Chotay Lal	1st April 1885	31st Mar. 1886.
			,, J. Sykes	16th Feb. 1886	5th Mar. 1886	Durga Parshad (*Asst.*)	1st April 1885	31st Dec. 1885.
			,, J. Cleghorn	6th Mar. 1886	31st Mar. 1886			
	Roorkee	Ditto	Capt. Harrison, R.E.	1st April 1885	30th June 1885	Chiranji Lal	1st April 1885	31st Mar. 1886.
			Dr. Murray Thomson	1st July 1885	31st Mar. 1886	Gunga Ram (*Asst.*)	1st April 1885	31st Dec. 1885.

N.-W. Provinces and Oudh—*concld.*	Chakrata	Third	Captain A. E. Ward	1st April 1885	19th May 1885	Salig Ram	1st April 1885	8th Nov. 1885.
			,, E. Glennie, R.E.	20th May 1885	19th July 1885	Bunwari Lal	9th Nov. 1885	2nd Dec. 1885.
			Lieutenant J. A Tanner, R.E.	20th July 1885	31st Oct. 1885	Corporal Sellers	3rd Dec. 1885	3rd Mar. 1886.
			Serjeant W. Chalmer	1st Nov. 1885	10th Mar. 1886	Bunwari Lal	4th Mar. 1886	31st Mar. 1886.
			Captain T. Digby, R.E.	11th Mar. 1886	31st Mar. 1886			
	Ranikhet	Ditto	......	......	......	Jewanand	1st April 1885	31st Mar. 1886.
	Dehra (S.G.O.)	Ditto	Deputy Superintendent, Survey of India.	1st April 1885	31st Mar. 1886	The Computers	1st April 1885	31st Mar. 1886.
	Bareilly	Ditto	E. A. Phillips, Esq.	1st April 1885	28th June 1885	M. Jwala Parshad	1st April 1885	30th Sep. 1885.
			H. O. Budden, Esq.	1st July 1885	31st Mar. 1886	M. Sundar Lal	1st Oct. 1885	31st Mar. 1886.
	Meerut	Ditto	Dr. W. Moir	1st April 1885	21st Aug. 1885	Harsaran Das	1st April 1885	31st Mar. 1886.
			,, R. Jameson	22nd Aug. 1885	27th Sep. 1885			
			,, O. Todd	28th Sep. 1885	31st Oct. 1885			
			,, E. A. FitzGerald	1st Nov. 1885	28th Feb. 1886			
			,, W. Moir	1st Mar. 1886	31st Mar. 1886			
	Gorakhpur	Ditto	,, C. Prentis	1st April 1885	31st Mar. 1886	Nizam-ud-din	1st April 1885	31st Mar. 1886.
	Ghazipur	Ditto	,, P. A. Weir	1st April 1885	31st Mar. 1886	Babu Mahabir	1st April 1885	31st Mar. 1886.
	Benares	Ditto	,, G. Thibaut	1st April 1885	31st Mar. 1886	Deoki Nandan Pathak	1st April 1885	15th Mar. 1886.
						Ram Ratna Pathak	16th Mar. 1886	31st Mar. 1886.
	Jhansi	Ditto	Surgeon-Major W. E. Moynan	1st April 1885	31st Mar. 1886	Kalka Das	1st April 1885	31st Mar. 1886.
	Pithoragarh	Ditto	Dr. S. Deasee	1st April 1885	31st Mar. 1886	Sher Singh	1st April 1885	31st Mar. 1886.
Punjab	Lahore	Second	,, E. Lawri	1st April 1885	9th April 1885			
			J. C. Oman, Esq.	10th April 1885	30th Nov. 1885	Jasput Rai	1st April 1885	31st Mar. 1886.
			W. L. Dallas, Esq.	1st Dec. 1885	31st Jan. 1886	Devan Chand (*Asst.*)	1st April 1885	31st Mar. 1886.
			J. C. Oman, Esq.	1st Feb. 1886	31st Mar. 1886			
	Mooltan	Third	Dr. T. E. L. Bate	1st April 1885	24th Mar. 1886	Wahid Ally Shah	1st April 1885	31st Mar. 1886.
			Sahib Ditta Mull	25th Mar. 1886	31st Mar. 1886			
	Dera Ismail Khan	Ditto	Surgeon-Major A. P. Holmes	1st April 1885	1st July 1885			
			Dr. C. Macartie	2nd July 1885	30th Sep. 1885	Noor Bukhsh	1st April 1885	25th May 1885.
			Surgeon-Major A. P. Holmes	1st Oct. 1885	26th Oct. 1885	Golam Mahmed	26th May 1885	8th July 1885.
			Dr. Duncan	27th Oct. 1885	31st Jan. 1886	Noor Bukhsh	9th July 1885	31st Mar. 1886.
			,, C. Macartie	1st Feb. 1886	31st Mar. 1886			

List showing the names of the Superintendents and Observers at the Meteorological Observatories in India, during the year 1885-86—continued.

PROVINCE.	Observatory.	Class.	Names of Superintendents.	PERIOD		Names of Superintendents.	PERIOD.	
				FROM	To		From	To
PUNJAB—*concld.*	Peshawar	Third	Dr. W. Coates	1st April 1885	30th Jan. 1886	Kashi Ram	1st April 1885	31st Mar. 1886.
			,, T. C. Chatterjee	21st Jan. 1886	29th Jan. 1886			
			,, G. F. Nicholson	30th Jan. 1886	31st Mar. 1886			
	Rawalpindi	Ditto	,, J. Bennet	1st April 1885	31st July 1885	Kalee Nath Rai	1st April 1885	31st Mar. 1886.
			,, S. J. Grant	1st Aug. 1885	2nd Nov. 1885			
			,, G. Nicholson	3rd Nov. 1885	20th Nov. 1885			
			,, J. Massey	21st Nov. 1885	31st Mar. 1886			
	Murree	Ditto	Geog. Peak, L.M.S.	1st April 1885	31st Mar. 1886	Mr. Cruickshank	1st April 1885	31st Mar. 1886.
	Sialkot	Ditto	Babu Sunder Mull	1st April 1885	24th April 1885	Babu Sunder Mull	1st April 1885	2nd April 1885.
			Dr. E. Palmer	25th April 1885	5th July 1885	Sardar Khan	3rd April 1885	31st Mar. 1886.
			Babu Sunder Mull	6th July 1885	26th Oct. 1885			
			Dr. W. A. O. Roe	27th Oct. 1885	31st Mar. 1886			
	Ludhiana	Ditto	Bhugwan Dass	1st April 1885	31st Mar. 1886	Brij Lall	1st April 1885	31st Mar. 1886.
	Chamba	Ditto	......	......	......	Dr. Burkhurdar Khan	1st April 1885	31st Mar. 1886.
	Simla	Ditto	Quarter Master General, India	1st April 1885	31st Mar. 1886	J. J. Konigs	1st April 1885	31st Mar. 1886.
	Kailang	Ditto	Revd. A. W. Heyde	1st April 1885	31st Mar. 1886	T. Dana	1st April 1885	31st Mar. 1886.
	Delhi	Ditto	Dr. G. C. Ross	1st April 1885	16th April 1885	Bunsee Dhar	1st April 1885	31st Mar. 1886.
			,, J. A. Cunningham	17th April 1885	20th Oct. 1885			
			,, G. C. Ross	21st Oct. 1885	26th Mar. 1886			
			,, T. E. L. Bate	27th Mar. 1886	31st Mar. 1886			
	Sirsa	Ditto	......	......	......	Lachman Dass	1st April 1885	8th May 1885.
						Permanand	9th May 1885	30th Mar. 1886.
	Nagpur	Second	Surgeon-Major R. T. Wright, M.D.	1st April 1885	7th May 1885	P. Soobiah	1st April 1885	31st Mar. 1886.
			,, T. F. Barter	8th May 1885	13th July 1885	Abed Hoosein (*Asst.*)	1st April 1885	31st Mar. 1886.
			,, R. T. Wright, M.D.	14th July 1885	23rd Jan. 1886			
			,, T. F. Barter	24th Jan. 1886	7th Feb. 1886			
			,, R. T. Wright, M.D.	8th Feb. 1886	31st Mar. 1886			

CENTRAL PROVINCES.	Jubbulpore	Ditto	Brigade Surgeon W. R. Rice, M.D.	1st April 1885	10th May 1885	Sadhuram Dubey	1st April 1885	31st Mar. 1886.
			Surgeon-Major R. T. Wright M.D.,	11th May 1885	6th July 1885	Ramlogan Singh (*Asst.*)	1st April 1885	31st Mar. 1886.
			Brigade Surgeon W. R. Rice, M.D.	7th July 1885	31st Mar. 1886			
	Pachmarhi	Ditto	Surgeon-Major R. Drury	1st April 1885	31st Mar. 1886	Pandit Krishna Rao	1st April 1885	28th Feb. 1886.
						T.M. Venkatachelem Pillay	1st Mar. 1886	31st Mar. 1886.
						T. M. Venkatachelm Pillay (*Asst.*)	1st April 1885	28th Feb. 1886.
						P. Raja Ruthnum (*Asst.*)	1st Mar. 1886	31st Mar. 1886.
	Saugor	Ditto	,, W. H. Booth	1st April 1885	13th Nov. 1885	Narain Rao	1st April 1885	24th Feb. 1886.
			,, J. B. Gaffney	14th Nov. 1885	31st Mar. 1886	Jadunath Bose	25th Feb. 1886	31st Mar. 1886.
	Hoshangabad	Ditto	Surgeon C. Henderson	1st April 1885	31st March 1886	Jadunath Bose	1st April 1885	24th Feb. 1886.
						Narain Rao	25th Feb. 1886	9th Mar. 1886.
						Govind Vithal	10th Mar. 1886	31st Mar. 1886.
	Seoni	Ditto	Surgeon-Major J. B. Gaffney	1st April 1885	31st Aug. 1885	Punchum	1st April 1885	31st Mar. 1886.
			,, H. K. McKay	1st Sept. 1885	31st Mar. 1886			
	Khandwa	Ditto	,, P. Cullen	1st April 1885	25th May 1885	Beharilal Parasar	1st April 1885	31st March 1886.
			,, G. R. Dapthary, M.D.	26th May 1885	18th Aug. 1885			
			Surgeon S. H. Browne, M. D.	19th Aug. 1885	31st Mar. 1886			
	Chanda	Ditto	Assistant Surgeon Shibchunder Bhattercharjee	1st April 1885	22nd Nov. 1885	Seetaram	1st April 1885	31st March 1886.
			Surgeon-Major B. Evers, M.D.	23rd Nov. 1885	31st Mar. 1886			
	Sironcha	Ditto	Narahar Govind, Tahsildar	1st April 1885	31st March 1886	Moothu Krishna Naidoo	1st April 1885	31st March 1886.
	Raipur	Ditto	Brigade Surgeon D. W. Trimnell	1st April 1885	31st Mar. 1886	Krishna Rao	1st April 1885	18th June 1885.
						Mr. Aggis	19th June 1885	20th Aug. 1885.
						Govind Ramchundra	21st Aug. 1885	31st Mar. 1886.
	Sambalpur	Ditto	Surgeon J. L. Poynder	1st April 1885	29th Oct. 1885	Syed Mahomed Hyder Hasseni Hydri	1st April 1885	8th Oct. 1885.
			,, Pedroza	30th Oct. 1885	31st Dec. 1885			
			,, J. L. Poynder	1st Jan. 1886	31st Mar. 1886	Annanth Ram Behara	9th Oct. 1885	31st Mar. 1886.
BERAR	Akola	Ditto	Surgeon J. J. Moran	1st April 1885	31st Mar. 1886	Samuel Gregory	1st April 1885	31st Mar. 1886.
	Buldana	Ditto	Apothecary Dr. Callaghan	1st April 1885	31st Mar. 1886	Husseni Beg	1st April 1885	31st May 1885.
						Shanker Ramrao	1st June 1885	31st July 1885.
						Abdul Karim	1st Aug. 1885	4th Sept. 1885.
						Luxmon Vinayek	5th Sept. 1885	14th Nov. 1885.
						Waman Pandurang	15th Nov. 1885	31st Mar. 1886.

List showing the names of the Superintendents and Observers at the Meteorological Observatories in India, during the year 1885-86.—continued.

PROVINCE.	Observatory.	Class.	Names of Superintendents.	PERIOD		Names of Observers.	PERIOD	
				From	To		From	To
BERAR—*concld.*	Chikalda	Third	Surgeon R. James	1st April 1885	17th June 1885	Hiralal	1st April 1885	31st March 1886.
			Assistant Apothecary W. Hendricks	18th June 1885	17th Aug. 1885			
			Surgeon R. James	18th Aug. 1885	25th Mar. 1886			
			Assistant Apothecary W. Hendricks	26th Mar. 1886	31st Mar. 1886			
	Amraoti	Ditto	Surgeon T. Hume	1st April 1885	16th April 1885	Bukaram Pandurang	1st April 1885	31st Mar. 1886.
			„ R. B. Roe	17th April 1885	13th July 1885			
			„ T. Hume	14th July 1885	31st Mar. 1886			
	Makhla	Fourth	J. Balantine	1st April 1885	31st Mar. 1886	Papannah	1st April 1885	31st Mar. 1886.
CENTRAL INDIA AND RAJPUTANA.	Jeypur	First	Surgeon-Major T. H. Hendley	1st April 1885	31st Mar. 1886	Durga Pershad Nathu Narayan Sheo Pertab	1st April 1885 1st April 1885 1st April 1885	31st Mar. 1886. 31st Mar. 1886. 31st Mar. 1886.
	Sutna	Third	„ S. J. Goldsmith	1st April 1885	31st Mar. 1886	Pandit Harnath	1st April 1885	31st Mar. 1886.
	Nowgong	Ditto	John Mather, Esq.	1st April 1885	31st Mar. 1886	Baldeva Parshad	1st April 1885	31st Mar. 1886.
	Neemuch	Ditto	Surgeon-Major E. C. R. Ward	1st April 1885	15th July 1885	T. Bachu	1st April 1885	7th Feb. 1886.
			Surgeon C. E. Nichol	16th July 1885	7th Sept. 1885	Ramji Khandriji	8th Feb. 1886	23rd Feb. 1886.
			„ S. J. Flood	8th Sept. 1885	15th Oct. 1885	T. Bachu	24th Feb. 1886	31st Mar. 1886.
			„ C. Nichol	16th Oct. 1885	15th Nov. 1885			
			Surgeon-Major F. Falwasser	16th Nov. 1885	31st Jany. 1886			
			Surgeon J. Lucas	1st Feby. 1886	8th Mar. 1886			
			„ D. V. O'Connell	9th Mar. 1886	31st Mar. 1886			
	Indore	Ditto	Surgeon-Major D. F. Keegan	1st April 1885	11th Aug. 1885	Trimbakrao	1st April 1885	31st Mar. 1886.
			„ R. Caldecott	12th Aug. 1885	9th Nov. 1885			
			„ D. F. Keegan	10th Nov. 1885	27th Mar. 1886			
			„ R. Caldecott	28th Mar. 1886	31st Mar. 1886			
	Mount Abu	Ditto	Surgeon-Major R. H. Robinson	1st April 1885	31st Dec. 1885	S. K. Gadgil	1st April 1885	1st May 1885.
			Assistant Apothecary J. W. Ranger	1st Jan. 1886	31st Mar. 1886	M. M. Talati	25th July 1885	31st Mar. 1886.

BOMBAY . .	Pachpadra . .	Ditto .	G. A. Bradford	1st April 1885	31st Mar. 1886	Murat Lall	1st April 1885	18th Oct. 1885.
						P. Halder	19th Oct. 1885	12th Feb. 1886.
						G. C. Banerji	13th Feb. 1886	24th Feb. 1886.
						P. Halder	25th Feb. 1886	31st Mar. 1886.
	Ajmere . . .	Ditto .	Surgeon-Major J. H. Newman, M.D.	1st April 1885	31st Mar. 1886	Ram Parshad	1st April 1885	31st Mar. 1886.
	Sambhar . .	Ditto .	F. Ashton, Esq.	1st April 1885	31st Mar. 1886	Muhammed Habibulla Khan . .	1st April 1885	31st Mar. 1886.
	Bickaneer . .	Ditto .	......	. ...	......	Ram Lall	1st April 1885	21st May 1885.
						Luchmandas	22nd May 1885	31st Mar. 1886.
	Belgaum . .	Second .	Surgeon-Major W. J. Campbell .	1st April 1885	30th April 1885	Ram Chandra Datta . . .	1st April 1885	31st Mar. 1886.
			„ R. P. Ferguson .	1st May 1885	31st Mar. 1886	Shantaram Wassudev (*Asst.*) .	1st April 1885	7th April 1885.
						Balaji Krishna (*Asst.*) . .	10th April 1885	31st Mar. 1886.
	Yerrowda (Poona) .	Ditto .	„ S. M. Solomon .	1st April 1885	31st Mar. 1886	Narayen S. Kelkar . . .	1st April 1885	31st Mar. 1886.
						C. S. Moodliar (*Asst.*) . .	1st April 1885	23rd Oct. 1885.
						Krishnaji Narain „ . .	30th Oct. 1885	28th Feb. 1886.
						G. C. Moodliar „ . .	1st Mar. 1886	31st Mar. 1886.
	Deesa . . .	Ditto .	„ W. P. Bridges .	1st April 1885	1st April 1885	Ramkrishna Keshav . . .	1st April 1885	31st Mar. 1886.
			Surgeon C. B. Maitland. . .	2nd April 1885	17th April 1885	Doyal Bhala (*Asst.*) . . .	1st April 1885	31st Mar. 1886.
			Surgeon-Major W. P. Bridges .	18th April 1885	30th April 1885			
			Surgeon C. B. Maitland. . .	1st May 1885	30th May 1885			
			Surgeon-Major W. P. Bridges .	31st May 1885	19th Nov. 1885			
			Surgeon A. S. Falkner . .	20th Nov. 1885	18th Dec. 1885			
			Surgeon-Major W. P. Bridges .	19th Dec. 1885	31st Mar. 1886			
	Kurrachee . .	Ditto .	Brigade Surgeon C. H Girand .	1st April 1885	31st Mar. 1886	Minguel Fernandez . . .	1st April 1885	31st Mar. 1886.
						Hassan Kádar (*Asst.*) . .	1st April 1885	31st Mar. 1886.
	Jacobabad . .	Third .	Surgeon B. N. Koyaji . . .	1st April 1885	30th Dec. 1885	Sheikh Ali	1st April 1885	31st Mar. 1886.
			„ A. Milve	31st Dec. 1885	28th Feb. 1886			
			„ H. Adey	1st Mar. 1886	31st Mar. 1886			
	Hyderabad (Sind) .	Ditto .	Surgeon-Major R. M. Craig . .	1st April 1885	31st May 1885	S. Pais	1st April 1885	31st May 1885.
			Surgeon H. Adey	1st June 1885	18th June 1885	Mahmed Yubiff	1st June 1885	13th Jan. 1886.
			Surgeon-Major H. De Fatham .	19th June 1885	31st Mar. 1886	Kison Sing	14th Jan. 1886	21st Jan. 1886.
						Hussan Khan	22nd Jan. 1886	31st Mar. 1886.
	Bhuj . . .	Ditto .	„ F. Jones . .	1st April 1885	31st Mar. 1886	Shankerji Naronji	1st April 1885	31st Mar. 1886.

List showing the names of the Superintendents and Observers at the Meteorological Observatories in India, during the year 1885-86—continued.

Province.	Observatory.	Class.	Names of Superintendents.	Period From	Period To	Names of Observers.	Period From	Period To
BOMBAY—*concld.*	Rajkot	Third	Surgeon-Major S. B. Haliday	1st April 1885	31st Jan. 1886	Hurry Sing Ruttan Sing	1st April 1885	30th Mar. 1886.
			Surgeon J. Wilkins	1st Feb. 1886	31st Mar. 1886			
	Sholapur	Ditto	W. R. Scroggie, Esq., L.R.C.P.	1st April 1885	31st Mar. 1886	Balwant Laxman	1st April 1885	31st Mar. 1886.
	Surat	Ditto	Surgeon-Major H. A. Lewis	1st April 1885	28th April 1885	Chhagan Lal Huri Lal	1st April 1885	31st Mar. 1886.
			„ S. O. B. Banks	29th April 1885	16th June 1885			
			„ H. Atkins	17th June 1885	25th June 1885			
			„ S. O. B. Banks	26th June 1885	30th Sept. 1885			
			Asstt. Surgeon Dassabhoy Pestanji	1st Oct. 1885	31st Dec. 1885			
			Surgeon-Major S. O. B. Banks	1st Jan. 1886	31st Mar. 1886			
	Malegaon	Ditto	No Superintendent	1st April 1885	14th April 1885	Shaikh Mohamed	1st April 1885	31st Mar. 1886.
			Surgeon A. F. Ferguson	15th April 1885	11th June 1885			
			No Superintendent	12th June 1885	31st Mar. 1886			
	Ratnagiri	Ditto	Surgeon H. McColman	1st April 1885	31st Mar. 1886	Mahadev Cuddum	1st April 1885	31st Mar. 1886.
	Karwar	Ditto	R. G. C. Westbrook, Esq.	1st April 1885	4th Jan. 1886	G. W. M. D'Aranjo	1st April 1885	31st Mar. 1886.
			A. R. Maidment, Esq.	5th Jan. 1886	7th Mar. 1886			
			R. G. C. Westbrook, Esq.	8th Mar. 1886	31st Mar. 1886			
	Bellary	Second	Surgeon-Major H. M. G. Archdall	1st April 1885	9th June 1885	B. G. Sashachellum Naidu	1st April 1885	13th July 1885.
			Surgeon H. Thompson, M.B.	10th June 1885	24th June 1885	P. Namasiroyam Pillay	14th July 1885	13th Aug. 1885.
			Surgeon-Major T. J. H. Wilkins	25th June 1885	5th Nov. 1885	B. G. Sashachellum Naidu	14th Aug. 1885	31st Mar. 1886.
			Asst. Surgeon W. D. Bartley	6th Nov. 1885	30th Nov. 1885	Sreenivasa Row, (*Asst.*)	1st April 1885	31st Mar. 1886.
			Surgeon T. H. Pope, M.B.	1st Dec. 1885	31st Mar. 1886			
	Trichinopoly	Ditto				T. Lutchman Row	1st April 1885	31st Mar. 1886.
			Surgeon-Major L. C. Nanney, M.D.	1st April 1885	5th Aug. 1885	E. M. Bhojarajulu Naidu (*Asst.*)	1st April 1885	22nd April 1885.
			„ H. Hyde	6th Aug. 1885	31st Mar. 1886	E. R. Sathoo Row (*Asst.*)	23rd April 1885	31st Mar. 1886.
	Gopalpore	Third	Port Officer	1st April 1885	31st Mar. 1886	G. Appalanarasimhum	1st April 1885	31st Dec. 1885.
						J. Suneasi Row	1st Jan. 1886	31st Mar. 1886.

MADRAS	Masulipatam	Ditto	Surgeon-Major J. B. Thomas, L. R. C.P.L.	1st April 1885	31st Mar. 1886	Uma Ranganayakulu Naidu	1st April 1885	30th June 1885.
						M. C. Lutchmeepathy Naidu	1st July 1885	31st Mar. 1886.
	Secunderabad	Ditto	Surgeon-Major G. F. Bevan	1st April 1885	17th June 1885	J. T. Williams	1st April 1885	31st Mar. 1886.
			,, T. C. H. Spencer	18th June 1885	31st Mar. 1886			
	Kurnool	Ditto	E. C. Johnson, Esq., C.S.	1st April 1885	15th Mar. 1886	G. R. Paramaswara Iyer	1st April 1885	31st May 1885.
						G. Narayansawmey Naidu	1st June 1885	8th July 1885.
			S. H. Wynne, Esq., B.A., C.S.	16th Mar. 1886	31st Mar. 1886	S. V. Varadarajullu Naidu	9th July 1885	31st Mar. 1886.
	Cuddapah	Ditto	Surgeon M. Iyasawmy	1st April 1885	3rd Jan. 1886	V. A. Vijiravalu Moodeliar	1st April 1885	31st Mar. 1886.
			Asst. Surgeon C. P. Ganapati, L.M.S.	4th Jan. 1886	18th Feb. 1886			
			Surgeon M. Iyasawmy	19th Feb. 1886	31st Mar. 1886			
	Bangalore	Ditto	Surgeon-Major A. F. Dobson, M.B.	1st April 1885	31st March 1886	Rungaswamy Moodeliar	1st April 1885	31st March 1886.
	Negapatam	Ditto	Surgeon H. St. C. Caruthers	1st April 1885	28th June 1885	S. Saminatha Iyer	1st April 1885	31st March 1886.
			Surgeon-Major A. H. Leapingwell	29th June 1885	27th Oct. 1885			
			Surgeon T. H. Pope, M.B.	28th Oct. 1885	13th Nov. 1885			
			3rd class Hospital Assistant M. Strenivasa Naidu.	14th Nov. 1885	19th Nov. 1885			
			1st grade Assistant Apothecary H. A. Henderson.	20th Nov. 1885	31st March 1886			
	Salem	Ditto	Surgeon J. Kernan	1st April 1885	26th Oct. 1885	L. Ramsing	1st April 1885	31st March 1886.
			,, W. F. Thomas	27th Oct. 1885	15th Nov. 1885			
			Assistant Surgeon M. Thummen Singh, M. B.	16th Nov. 1885	31st March 1886			
	Coimbatore	Ditto	Surgeon S. C. Sarkies	1st April 1885	3rd June 1885	Varadia Naidu	1st April 1885	31st May 1885.
			Surgeon-Major J. F. Fitzpatrick, M.D.	4th June 1885	31st March 1886	C. S. Saminatha Pillay	1st June 1885	31st March 1886.
	Madura	Ditto	Surgeon F. C. Smith	1st April 1885	31st March 1886	N. E. Kangayan Pillay	1st April 1885	30th April 1885.
						V. Sashachellum Naidu	1st May 1885	31st May 1885.
						G. R. Paramaswara Iyer	1st June 1885	31st March 1886.
	Calicut	Ditto	Captain F. M. Gillham	1st April 1885	31st March 1886	F. D'Rozario	1st April 1885	31st March 1886.
	Cochin	Ditto	Brigade Surgeon W. H. Morgan	1st April 1885	31st Oct. 1885	M. V. Eippe	1st April 1885	31st March 1886.
			2nd grade Apothecary O. W. Jones, M.D.	1st Nov. 1885	28th Jan. 1886			
			Brigade Surgeon W. H. Morgan	29th Jan. 1886	31st March 1886			
	Wellington	Ditto	Surgeon-Major W. G. Grant	1st April 1885	10th Dec. 1885	H. Brownsell	1st April 1885	31st March 1886.
			,, W. Keir	11th Dec. 1885	31st March 1886			

List showing the names of the Superintendents and Observers at the Meteorological Observatories in India, during the year 1885-86—concluded.

PROVINCE.	Observatory.	Class.	Names of Superintendents.	PERIOD.		Names of Observers.	PERIOD.	
				From	To		From	To
MADRAS—*concld.*	Mercara	Third	Surgeon-Major Mark Robinson	1st Feb. 1886	31st March 1886	T. S. Arnnachellum Pillay	1st April 1885	22nd July 1885.
						A. M. Venkatasiah	23rd July 1885	31st Dec. 1885.
						Sivaram Moodeliar	1st Jan. 1886	31st Jan. 1886.
						C. Venket Kristnaya	1st Feb. 1886	31st March 1886.
	Mangalore	Ditto	......	......	......	D. T. D'Souza	1st April 1885	8th Oct. 1885.
						S. J. Croning	9th Oct. 1885	31st March 1886.
	Rajahmundry	Ditto	Surgeon-Major E. Levinge	1st April 1885	31st March 1886	A. Mukunda Row Naidu	1st April 1885	31st March 1886.
	Cocanada	Ditto	Port Officer	1st April 1885	31st March 1886	C. J. M. Gaetane	1st April 1885	31st March 1886.
BURMA	Rangoon	Second	Surgeon-Major H. Johnstone, M.D.	1st April 1885	31st March 1886	G. E. Wales	1st April 1885	31st March 1886.
						O. White (*Asst.*)	1st April 1885	31st March 1886.
	Bassein	Third	Surgeon S. H. Dantra	1st April 1885	31st March 1886	Moung Pé	1st April 1885	31st March 1886.
	Diamond Island	Ditto	......	......	......	F. W. Marsh	1st April 1885	31st March 1886.
	Akyab	Ditto	......	......	......	Mr. E. B. Atkinson	1st April 1885	31st Dec. 1885.
							11th Feb. 1886	31st March 1886.
						,, M. McSweeny	1st Jan. 1886	10th Feb. 1886.
	Thayetmyo	Ditto	Surgeon W. P. Dalzell	1st April 1885	25th Sept. 1885	Alladeen	1st April 1885	31st March 1886.
			Surgeon-Major J. Backhouse, F.R.C.S.	26th Sept. 1885	31st Dec. 1885			
			Surgeon E. P. Frenchman	1st Jan. 1886	31st March 1886			
	Mergui	Ditto	Mr. P. G. Paul	1st April 1885	13th Feb. 1886	Moosajee	1st April 1885	31st March 1886.
			,, Robert Hall Nailer	14th Feb. 1886	31st March 1886			
	Tounghoo	Ditto	Surgeon Maurice Smith	1st April 1885	10th Nov. 1885	Shaik Hydiat Ally	1st April 1885	31st March 1886.
			Mr. G. B. Fonseca	11th Nov. 1885	9th Dec. 1885			
			Surgeon C. S. Rundle	10th Dec. 1885	31st March 1886			
	Moulmein	Ditto	Brigade Surgeon W F. DeFabeck, M.D.	1st April 1885	22nd Sept. 1885	T. St. Hilbert	1st April 1885	31st March 1886.
			Surgeon R. Ross	23rd Sept. 1885	13th Oct. 1885			
			Surgeon-Major Oswald Baker	14th Oct. 1885	31st March 1886			

BAY ISLANDS	Port Blair	Third				J. T. Peters	1st April 1885	7th Nov. 1885.
						G. T. Carrol	8th Nov. 1885	31st March 1886.
			Surgeon-Major W. N. Keefer, M.B.	1st April 1885	10th Oct. 1885			
			Surgeon S. F. Bigger, M.B.	11th Oct. 1885	21st Dec. 1885	S. Thomas	1st April 1885	16th April 1885.
			Surgeon-Major W. N. Keefer, M.B.	22nd Dec. 1885	31st March 1886	Shaik Abdool Wahed	17th April 1885	14th May 1885.
						Rahmatoollah	15th May 1885	31st Augt. 1885.
	Nancowry	Ditto				Shaik Madar	1st Sept. 1885	30th Sept. 1885.
						Mahomed Abdool Jubber	1st Oct. 1885	24th Dec. 1885.
						Shaik Kabeeroodeen	25th Dec. 1885	17th March 1886.
						S. Thomas	18th March 1886	31st March 1886.
EXTRA INDIAN	Leh	Second	......	......	......	Laskyab	1st April 1885	31st March 1886.
						Hushmut Ali (*Asst.*)	1st April 1885	14th July 1885.
						Haidar Ditto	15th July 1885	31st March 1886.
	Aden	Ditto	Major F. M. Hunter, C.B., C.S.I.	1st April 1885	31st March 1886	W. Abraham	1st April 1885	31st March 1886.
						B. Cordeiro (*Asst.*)	1st April 1885	31st March 1886.
	Bushire	Third	Lieut.-Col. S. B. Miles	1st April 1885	31st March 1886	Mr. A. Paes	1st April 1885	31st Oct. 1885.
						,, H. M. Cumming	1st Nov. 1885	31st March 1886.
	Quetta	Ditto	Surgeon J. C. Fullerton, M.B.	1st April 1885	31st March 1886	A. Samuel Pillay	1st April 1885	31st March 1886.
	Katmandu	Ditto	......	......	......	Mahomud Hossain	1st April 1885	18th May 1885.
						Pashupat Saran Sinha	19th May 1885	24th June 1885.
						Mahomud Hassain	25th June 1885	31st March 1886.
	Amini Divi	Ditto	......	......	......	Hospital Assistant Syed Laul	1st April 1885	31st March 1886.

APPENDIX D.

Return of the Stock, Receipt and Issue of Instruments for the year 1885-86.

Instruments.	In store on 1st April 1885.	Received, 1885-86.	Issued, 1885-86.
Van Rysselberghe's meteorograph	1	...	1
Barometers, observatory, Fortin's principle	9	10	7
Do. do. Kew principle	6	4	8
Do. mountain, portable tripod (Adie)	20	10	10
Do. marine, Kew principle	21	2	3
Do. Newman's large standard	2	...	...
Do. do. small standard	3	...	...
Do. Negretti and Zambra (various)	7	9	3
Aneroids	18	1	2
Hick's barograph	1	...	...
Thermometers, standard, with attached scales	16	...	7*
Do. do. without attached scales (chemical)	1	...	1
Do. for hygrometers (Kew pattern)	36	14	20
Sling thermometers	7	...	4
Thermometers, maximum, for shade	68	13	26*
Do. solar in vacuo (self-registering)	9	43	35†
Do. do. do. (non-self-registering)	21	...	5
Do. do not in vacuo	2	...	...
Do. minimum, for shade	33	26	31
Do. do. for radiation	14	33	26
Six's thermometers	6	1	...
Traveller's maximum and minimum thermometers	...	6	...
Frankland's sun thermometers	3	1	1
Boiling point thermometers	7	...	...
Thermograph, with Negretti and Zambra's sets of recording thermometers	1	...	...
Common thermometers, brass scales	27	...	1
Ponillet's pyrheliometer	1	...	...
Stewart's actinometer (thermometers for)	7	...	...
Do. do. (chamber for)	1	...	...
Hodgkinson's do.	2	...	...

* 1 condemned as unserviceable.
† 2 do. do.

Return of the Stock, Receipt and Issue of Instruments for the year 1885-86—concluded.

Instruments.	In store on 1st April 1885.	Received, 1885-86.	Issued, 1885-86.
Herschell's actionometer	1	...	...
Regnault's hygrometers	3	...	...
Daniell's do.	10	...	...
Halleur's do.	5	...	...
Pocket spectroscopes (Browning's)	2	...	1
Anemometers	18	16	27
Wind-vanes	...	21	19
Beckley's anemograph	...	1	...
Casella's do.	...	2	...
Electric anemometer and wind-vanes	3	...	...
Rain-gauges (Symons') 5″ diameter	48	10	20
Do. 6″ do.	1	...	...
Self-registering rain-gauge (Casella's)	...	1	...
Measure-glasses for 5″ rain-gauges	8	17	24
Do. do. 6″ do.	2	...	...
Reading lenses	2	2	3
Sun thermometer-stands	4	10	3
Radiation pads	2	2	4
Thermometer cages	3	7	6
Do. do. for ships	14	...	1
Prismatic compasses	1	2	2
Magnetic do.	...	7	7
Sand-glasses (3 minutes)	43	...	26
Sunshine recorders	3	...	2
Bull's-eye lanterns	...	1	1
Salinometers	35	1	36
Clocks	...	9	9
Spirit-level	1	...	...
Electrophorus	1	...	...
Filled tubes for marine Kew principle barometers	12	...	2
Do. do. observatory, do. do. do.	8	12	1
Do. do. Adie's mountain Fortin barometers	...	4	4
Chain for Casella's embossing anemograph	100 ft.	...	100 ft.
Glass cylinder jars	2	...	...

APPENDIX E.

Return of the Instruments issued to each Observatory in 1885-86.

PROVINCE.	STATIONS.	Barometer.	HYGROMETER.		Dry maximum thermometer.	MINIMUM THERMOMETER.		RADIATION THERMOMETER.		Anemometer.	Wind-vane.	Rain-gauge.	Measure-glass.	Lens.	Clock.	Sand-glass.	Stand for sun thermometer.	Pad for grass radiation thermometer.	Cages.	Anemograph, Beckley's.	Aneroid.	Standard thermometer.	Sling thermometer.	Bull's-eye lantern.	Actinometer thermometer.	Nephescope.	Frankland's sun thermometer.	Sunshine recorder.	Salinometer.	Meteorograph.	Spectroscope.	Compass.	Filled tubes for marine K. P. barometer.	Filled tubes for observatory K. P. barometer.	Filled tubes for Adie's mountain Fortin's barometer.
			Dry.	Wet.		Dry.	Wet.	Solar.	Grass.																										
Arabia	Aden	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Beluchistan.	Quetta	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cashmere.	Leh	...	...	...	...	2	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Nepal	Katmandu	2	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Punjab.	Kailang	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Mooltan	...	...	1	...	1	1	2	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Dera Ismail Khan	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Peshawar	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Murree	...	...	...	...	...	1	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Rawalpindi	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Sialkot	...	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Lahore	...	...	...	1	...	...	3*	1	...	...	...	...	2	...	...	...	...	...	...	...	5	...	...	...	...	...	1	...	...	...	...	...	...	...
	Ludhiana	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Sirsa	...	1	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
N.-W. P. and Oudh.	Chakrata	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Ranikhet	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Pithoragarh	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Meerut	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bareilly	...	...	...	...	...	...	1	1	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Agra	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Lucknow	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Gorakhpur	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Allahabad	...	1	1	2	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1	...	1	...	...	...	...	...
	Benares	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Ghazipur	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Assam	Tezpur†	1	1	1	1	1	1	1	1	1	1	1	1	...	...	...	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bengal.	Patna	...	...	...	...	...	...	...	...	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Gya	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Hazaribagh	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Burdwan	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Jessore	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Chittagong	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Demagiri	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Alipore	...	...	1	...	...	...	...	1	...	...	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...
	False Point	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Arrah	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

* One non-self-registering.
† Original furniture.

Return of the Instruments issued to each Observatory in 1885-86—continued.

PROVINCE.	STATIONS.	Barometer.	HYGROMETER.		Dry maximum thermometer.	MINIMUM THERMOMETER.		RADIATION THERMOMETER.		Anemometer.	Wind-vane.	Rain-gauge.	Measure-glass.	Lens.	Clock.	Sand-glass.	Stand for sun thermometer.	Pad for grass radiation thermometer.	Cages.	Anemograph, Beckley's.	Aneroid.	Standard thermometer.	Sling thermometer.	Bull's-eye lantern.	Actinometer thermometer.	Nephescope.	Frankland's sun thermometer.	Sunshine recorder.	Salinometer.	Meteorograph.	Spectroscope.	Compass.	Filled tubes for marine K. P. barometer.	Filled tubes for observatory K. P. barometer.	Filled tubes for Adie's mountain Fortin's barometer.
			Dry.	Wet.		Dry.	Wet.	Solar.	Grass.																										
BENGAL.—*concld.*	Balasore	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bankoora*	1	1	1	1	1	...	...	...	1	1	1	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bhagulpore	...	1	...	...	...	...	...	...	1	1	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bogra	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Burrisal	...	...	...	2	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Chupra	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Furreedpore	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Krishnagar*	2	1	1	2	1	...	...	...	1	1	1	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Maldah*	2	1	1	1	2	...	...	...	1	1	1	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Midnapore	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Mymensingh	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Noakhally	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Ranchee	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Rungpore	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Serajgunge	...	...	...	...	...	...	...	...	2	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
CENTRAL PROVINCES.	Raipur	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Nagpur	...	...	2	...	...	...	2	1	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...
	Seoni	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Jubbulpore	...	1	1	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Saugor	...	...	...	...	...	...	2	...	2	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Pachmarhi	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Hoshangabad	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Khandwa	...	...	...	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
BERAR.	Chikalda	...	...	...	...	...	...	...	...	...	...	1	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Buldana	...	...	1	1	1	1	...	...	1	...	...	...	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Amraoti	...	...	1	...	...	...	...	...	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Akola	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
CENTRAL INDIA.	Neemuch	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Indore	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Nowgong	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Sutna	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
RAJPUTANA.	Mount Abu	...	...	...	...	...	...	...	...	1	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bickaneer	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Sambhar	...	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Ajmere*	...	1	1	1	1	1	1	1	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
BOMBAY	Jacobabad	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
	Hyderabad	1	...	...	...	...	...	...	...	1	1	1	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Kurrachee	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bhuj	...	...	...		...	...	...	1	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Rajkot	...	...	...	...	2	...	...	...	1	...	...	...	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

* Original furniture.

Return of the Instruments issued to each Observatory in 1885-86—concluded.

Province.	Stations.	Barometer.	Hygrometer.		Dry maximum thermometer.	Minimum thermometer.		Radiation thermometer.		Anemometer.	Wind-vane.	Rain-gauge.	Measure-glass.	Lens.	Clock.	Sand-glass.	Stand for sun thermometer.	Pad for grass radiation thermometer.	Cages.	Anemograph, Beckley's.	Aneroid.	Standard thermometer.	Sling thermometer.	Bull's-eye lantern.	Actinometer thermometer.	Nephescope.	Frankland's sun thermometer.	Sunshine recorder.	Salinometer.	Meteorograph.	Spectroscope.	Compass.	Filled tubes for marine K. P. barometer.	Filled tubes for observatory K. P. barometer.	Filled tubes for Adie's mountain Fortin's barometer.
			Dry.	Wet.		Dry.	Wet.	Solar.	Grass.																										
Bombay—*concld.*	Deesa	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Surat	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Malegaon	...	...	...	...	...	1	...	1	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Poona	...	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Sholapur	...	1	...	...	...	...	1	1	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Ratnagiri	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Karwar	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Madras and Mysore.	Gopalpore	...	...	...	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Rajahmundry	...	...	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Masulipatam	...	...	...	1	...	...	2	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Secunderabad	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Kurnool	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bellary	...	...	...	...	...	1	1*	1	1	1	1	1	...	...	...	†1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bangalore	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Cuddapah	2	...	...	1	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Coimbatore	...	...	...	1	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Trichinopoly	...	...	...	...	...	...	1*	...	1	...	...	1	...	...	...	†1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Negapatam	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Madura	...	1	...	2	...	...	1	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Burma	Rangoon	...	...	...	...	...	...	1*	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Toungoo	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Moulmein	1	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Diamond Island	...	...	1	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bay Islands.	Nancowry	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Beluchistan.	Pishin	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	F. L. V. "Star"	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Pilot vessel "Guide"‡	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	F. L. V. "Meteor"	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Cocos Island‡	1	1	1	1	1	1	...	...	1	1	1	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Forest Dept., Ajmere	...	2	2	1	2	2	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	" " Madras	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	" " Assam	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Afghan Boundary Commission.	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	...	...	...	...	...	...	...	1	...	...	...
	Bagelkhand Agency	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Metl. Office, Bengal	...	...	...	...	...	...	...	...	...	...	10	14	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	" " Punjab	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1	1	...	...	...
	" " Bombay	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
	" " Simla	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
	Mathl. Instt. Departt.	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	36	...	...	...	...	...	...

* Non-self-registering.
† For ditto.

‡ Original furniture.

APPENDIX F.

List of Recipients of the Publications of the Meteorological Office.

Adelaide	Meteorological Observatory.
Agra	The Editor of the *Delhi Gazette.*
Ajmere	Chief Commissioner of Ajmere.
Akola	Sanitary Commissioner for Berar.
Algeria	Director of the Meteorological Service of the École des Sciences d'Alger.
Allahabad	Secretary to the Government, North-Western Provinces and Oudh.
	Department of Revenue and Agriculture, North-Western Provinces and Oudh.
	Meteorological Reporter, North-Western Provinces and Oudh.
	Sanitary Commissioner, ditto ditto.
	Editor of the *Pioneer.*
Amsterdam	Royal Academy of Sciences.
Bangalore	Chief Commissioner, Mysore and Coorg.
	Conservator of Forests, Mysore and Coorg.
Batavia, Java	Meteorological Observatory.
Berlin	Royal Prussian Meteorological Institute.
Bombay	Secretary to the Government of Bombay.
	Meteorological Reporter for Western India.
	Colaba Observatory.
	Sanitary Commissioner with the Government of Bombay.
	Bombay University.
	Asiatic Society of Bombay.
	Sassoon Mechanics' Institute.
	Geographical Society of Bombay.
	Editor of the *Bombay Gazette.*
	Ditto *Times of India.*
	Elphinstone College.
Brisbane, Queensland	Observatory.
Brussels	Royal Academy of Sciences.
	Observatoire Royal.
Bucharest, Roumania	Meteorological Institute.
Budapesth	Observatory.
Calcutta	H. M. Secretary of State for India (through Revenue and Agricultural Department).
	Secretary to the Government of India, Revenue and Agricultural Department.
	Ditto ditto, Home Department.
	Ditto ditto, Public Works Department.
	Ditto ditto, Foreign Department.
	Ditto ditto, Department of Finance and Commerce.
	Ditto ditto, Military Department.
	Private Secretary to His Excellency the Viceroy.
	Secretary to the Government of Bengal, Revenue Department.
	Meteorological Reporter to the Government of Bengal.
	Surveyor General of India.
	Director, Geological Survey of India.
	Sanitary Commissioner with the Government of India.
	Ditto ditto ditto Bengal.
	Superintendent, Botanical Gardens, Calcutta.
	Inspector-General of Forests with the Government of India.
	Surgeon-General ditto ditto.
	Asiatic Society of Bengal.
	Indian Museum Library.
	Calcutta University.
	Presidency College.
	Public Library.
	Editor of the *Calcutta Review.*
	Ditto *Statesman and Friend of India.*

List of Recipients of the Publications of the Meteorological Office—continued.

Calcutta—*concld.*	Editor of the *Englishman.* Ditto *Indian Daily News.* Ditto *Hindu Patriot.* Ditto *Indian Agriculturist.* St. Xavier's College Observatory. The Alipore Observatory. Mint Master. Indian Association for the Cultivation of Science.
Cambridge	University Library (through H. M.'s Secretary of State for India).
Cambridge, Massachusetts	Harvard University.
Cape of Good Hope	Astronomer Royal.
Carlsruhe, Baden, Germany	Bureau für Meteorologie und Hydrographie.
Chemnitz	Royal Meteorological Institute.
Chatham	Royal Engineers' Library (through Revenue and Agricultural Department).
Christiania	Norske Meteorologiske Institut. Royal Observatory.
Colombo	Editor of the *Ceylon Times.* Ditto *Ceylon Observer.* Surveyor General of Ceylon.
Constantinople	Observatoire Impérial Météorologique.
Copenhagen	Danske Meteorologiske Institut. Royal Danish Academy of Sciences.
Cordoba	Meteorological Office. National Academy of Science.
Darjeeling	Conservator of Forests, Government of Bengal.
Dehra Dun	Editor of the *Indian Forester.* Superintendent, Great Trigonometrical Survey.
Dharwar	Conservator of Forests, Bombay, Southern Division.
Dublin	Royal Dublin Society.
Dacca	Dacca College.
Edinburgh	Scottish Meteorological Society. Astronomer Royal for Scotland, Royal Observatory. Scottish Geographical Society (through H. M.'s Secretary of State for India).
Ellichpore	Assistant Conservator of Forests, Melghat Division.
Goa	Royal Observatory.
Greenwich	Astronomer Royal, Royal Observatory.
Guatemala	Observatorio Meteorologico del Institut Nacional de Guatemala.
Hamburgh	Nord Deutsche Seewarte. Deutsche Meteorologische Gessellschaft.
Havana	Real Collegio de Belen.
Hong-Kong	Observatory.
Indore	Agent to the Governor General for Central India in charge of the Residency.
Iowa, U. S.	Iowa Weather Service.
Jeypore	Maharajah's Observatory.
Jubbulpore	Civil Surgeon of Jubbulpore.
Katmandu	Resident at Nepal.
Khandwa	Civil Surgeon of Nimar.
Kitzingen, Bavaria	Dr. Emil Von Schlagintweit.
Kurrachee	Conservator of Forests, Bombay, Sind Division.
Lahore	Secretary to the Government of the Punjab. Meteorological Reporter ditto ditto. Sanitary Commissioner ditto ditto. Conservator of Forests ditto ditto. Editor of the *Indian Public Opinion.*
Leeds	Yorkshire College (through H. M.'s Secretary of State for India).
Lisbon	Observatoire de Infante d'Luiz. Academy of Sciences.
London	Meteorological Council. Royal Society. Royal Asiatic Society (through H. M.'s Secretary of State for India). Northbrook Indian Club (through H. M.'s Secretary of State for India).

List of Recipients of the Publications of the Meteorological Office—continued.

London—*concld.*	Society of Arts.
	Institution of Civil Engineers.
	Royal School of Mines.
	Royal Meteorological Society.
	Admiralty Library.
	United Service Museum.
	British Museum (through H. M.'s Secretary of State for India).
	Athenæum Club.
	Editor of the *Philosophical Magazine.*
	Ditto *Athenæum.*
	Ditto *Nature.*
	Ditto *Symons's Monthly Meteorological Magazine.*
	Ditto *Westminster Review.*
	Ditto *Quarterly Review.*
Madras	Secretary to the Government of Madras.
	Ditto ditto Public Works Department.
	Meteorological Reporter to the Government of Madras.
	Government Astronomer, Madras.
	Sanitary Commissioner, Government of Madras.
	Madras University.
	Editor of the *Madras Times.*
	Ditto *Madras Mail.*
	Superintendent, Government Central Museum.
	Assistant Director of Agriculture, Government of Madras.
	Surgeon General, British Medical Department.
	Ditto, Indian Medical Department.
	Master Attendant of Madras.
	Conservator of Forests, Northern Circle.
Madrid	Royal Observatory.
Magdeburgh	Observatory of the Magdeburgh Zeitung.
Manchester	Literary and Philosophical Society.
Manila	Meteorological Observatory.
Mauritius	Meteorological Society.
Melbourne, Victoria	Observatory.
	University Library.
	Public Library.
Mexico	Central Meteorological Observatory.
Milan	Royal Astronomical Observatory.
Munich	Royal Observatory.
	Royal Bavarian Academy of Sciences.
	Geographical Society.
Nagpur	Chief Commissioner, Central Provinces.
	Sanitary Commissioner, ditto.
	Inspector General of Education, Central Provinces.
	Superintendent, Meteorological Observatory.
	Conservator of Forests, Central Provinces.
Naini Tal	Ditto ditto, North-Western Provinces and Oudh.
New Haven, Connecticut	Connecticut Academy of Arts and Sciences.
	Editors of the *American Journal of Science.*
New York, U. S.	Central Park Observatory.
Nowgong-Rajshahye	Sub-Divisional Officer.
Ootacamund	Conservator of Forests, Government of Madras.
	Editor of the *South of India Observer.*
Oxford	Radcliffe Library.
	Radcliffe Observatory.
Paris	Observatoire Physique Central de Montsouris.
	Editor of *La Nature.*
	Physical Observatory, Meudon.
	Bureau Central Météorologique.
	Meteorological Society of France.
Perpignan, France	Observatorie Météorologique et Magnetique.

List of Recipients of the Publications of the Meteorological Office—concluded.

Perth, W. Australia	Surveyor General.
Pesaro, Italy	Royal Observatory.
Philadelphia	Franklin Institute.
Poona	Conservater of Forests, Bombay, Northern Division.
Prag, Bohemia	Observatory.
Raipur	Civil Surgeon of Raipur.
Rangoon	Chief Commissioner, Burma.
	Sanitary Commissioner, ditto.
	Conservator of Forests, ditto.
	Editor of the *Rangoon Times*.
Rome	Meteorological Office (Ministry of Agriculture).
Rio de Janeiro	Imperial Observatory.
Saharunpore	Superintendent, Botanic Gardens.
Secunderabad	Secretary to the Resident at Hyderabad.
Shillong	Chief Commissioner of Assam.
	Conservator of Forests, Assam.
Simla	Assistant Quarter Master General, Intelligence Branch.
Singapore	Principal Civil Medical Officer, Straits Settlements.
Stockholm	Nautisk Meteorologiska Byran.
St. Petersburg	Observatoire Physique Central.
	Geographical Society of Russia.
	Prof. H. Wild, Central Physical Observatory.
Strasburg	Imperial University Library.
Stonyhurst	Stonyhurst College Observatory.
Sydney	Observatory.
	University Library.
Syracuse, Sicily	Royal Meteorological Observatory.
Tasmania	Royal Society.
Tiflis, Russia	Physical Observatory.
Tokei, Japan	Imperial Mining Office.
	Imperial Meteorological Observatory.
Toronto, Canada	Magnetical and Meteorological Observatory.
Turin	Royal Astronomical Observatory.
	Meteorological Society of Italy.
Upsala	Meteorological Observatory.
Utrecht	Royal Netherlands Meteorological Institute.
Vienna	K.K. Central-Anstalt für Meteorologie und Erdmagnetismus.
	K.K. Geologische Reichsanstalt.
	Imperial Academy of Sciences.
	Dr. J. Hann.
Vizagapatam	A. V. Nursingrow, Esquire.
Washington, U. S.	Chief Signal Officer, United States Army.
	Smithsonian Institution.
	Naval Observatory.
	Hydrographic Office.
	Professor Cleveland Abbe, Signal Office.
	United States Geological Survey.
Wellington, New Zealand	Observatory.
Woolwich	Royal Artillery Library.
Zi-ka-wei, Shanghai	Magnetical and Meteorological Observatory.
Zurich	Central Meteorological Institute.

APPENDIX G.

Presentations to the Library from the 1st April 1885 to the 31st March 1886.

Place.	Donors.	Title of work.
ALGIERS	Meteorological Service	Bulletin Météorologique du Gouvernement général de l'Algérie, 16th February 1885 to 15th February 1886.
		Bulletin Mensuel, December 1884, and February to June 1885.
ALLAHABAD	Meteorological Office	Administration Report of the Meteorological Reporter to the Government of the North-Western Provinces and Oudh for the year 1884-85.
		Sketch of the Meteorology of the year 1884 in the North-Western Provinces and Eastern Rajputana.
AMSTERDAM	Royal Academy of Sciences	Verslagen en Mededeelingen der Koninklijke Akademie van Wetenschapen Afd Natuurkunde, Tweede Reeks, Deels XIX and XX.
		Processen verbaal, 1883-84.
		Naam en zaakregester op Akad, &c., Tweede Reeks, Deel I—XX.
		Jaarboek, 1883.
BATAVIA	Magnetical and Meteorological Observatory.	Rainfall in the East Indian Archipelago, sixth year, 1884.
		Observations made at the Magnetical and Meteorological Observatory in Batavia, Vol. VI, parts I and II.
BERLIN	Austrian and German Meteorological Society.	Meteorologische Zeitschrift, January and February 1886.
	Dr. G. Hellman	Ueber gewisse Gesetzmässigkeiten im Wechsel der Witterung aufeinanderfolgender Jahreszeiten.
	Royal Prussian Statistical Bureau	Preussische Statistik-Ergebnisse der Meteorologischen Beobachtungen im Jahre 1884.
BOMBAY	Government of Bombay	Annual Report of the Sanitary Commissioner for the Governnent of Bombay for 1884.
		Bombay Gazetteer, Vol. XVIII, parts I to III.
	Government Observatory	Magnetical and Meteorological observations made at the Government observatory, Bombay, during the years 1883 and 1884.
	Meteorological Office	Brief sketch of the Meteorology of the Bombay Presidency in 1883-84.
BOSTON	Reception Committee	Addresses at the Complimentary dinner to Dr. Benjamin Apthorp Gould.
BRUSSELS	Royal Academy of Sciences	Bulletin, 3rd series, Tomes VI to VIII.
		Annuaire, 1884 and 1885.
		Jours de solitude.
BUCHAREST	Institutul Meteorological Romaniei	Buletinul Ministerului agriculturei, industreii, comerciului si domenütor, Anul I, 1885, Nos. 2 to 7.
BUDAPESTH	K. Central Anstalt für Meteologie- und Erdmagnetismus.	Jahrbücher. Bände X to XIV.
CALCUTTA	Comptroller and Auditor General	Civil Budget Estimate for the year 1885-86.
	Director-General of Post Offices in India.	Indian Postal Guide, No. XXV, October 1885.
	Geological Survey of India	Memoirs of the Geological Survey of India, Vol. XXI, parts 3 and 4.
		Records of the Geological Survey of India, Vol. XVIII, parts 2 to 4; Vol. XIX, part I.
	Government of Bengal	Returns of the rail-borne traffic of Bengal during the quarters ending 31st March 1884, and 31st March, 30th June and 30th September 1885.
		Report on the external trade of Bengal with Nepal, Sikkim, and Bhutan for 1884-85.
		Report on the rail-borne traffic of Bengal during the year 1884-85.
		Report on the river-borne traffic of the lower provinces of Bengal and on the inland trade of Calcutta and on the trade of Chittagong and the Orissa ports for the year 1884-85.

Presentations to the Library from the 1st April 1885 to the 31st March 1886—continued.

Place.	Donors.	Title of Work.
CALCUTTA—*concld.*	Government of India, Home Department	Report of the Meteorological Council to the Royal Society for the year ending 31st March 1884.
		Forest Department; Code of Instructions.
	Government of India, Revenue and Agricultural Department	Appendix to the Report of the Indian Famine Commission, Vol. VI.
		Report of the Indian Famine Commission, Part III, Famine Histories.
		Official Report of the Calcutta International Exhibition, 1883-84, Vols. I and II.
		Administration Report on the Madras Observatory for the year 1884.
	Henry F. Blanford, F.R.S.	Connexion of the Himalayan snowfall with dry winds and seasons of drought in India. (Pamphlet.)
	Meteorological Office, Bengal	Administration Report of the Meteorological Reporter to the Government of Bengal for 1884-85.
	Sanitary Commissioner with the Government of India	Annual Report of the Sanitary Commissioner with the Government of India for 1884.
	St. Xavier's College Observatory	Meteorological observations recorded at the St. Xavier's College Observatory, July 1884 to December 1885.
	Surveyor General of India	General Report on the operations of the Survey of India Department during 1883-84.
CAMBRIDGE	University	Twenty-first Annual Report of the Library Syndicate.
CAPODIMONTI (NAPLES).	Astronomical observatory	Recerche Numerichi sulla latitudini del R. Osservatorio di capodimonti, part I.
CARLSRUHE	Bureau für Meteorologie und Hydrographie, Baden	Jahres-Bericht für das Jahr 1884.
		Beiträge zur Hydrographie des Grossherzogthums Baden, Zweites Heft.
CHRISTIANIA	Norwegian Meteorological Institute	Jahrbücher für 1881, 1882, and 1884.
COLOMBO	Surveyor General of Ceylon	Administration Report, 1884 (Part III, Scientific) Meteorology.
COPENHAGEN	Institut Météorologique Danois	Bulletin Météorologique du Nord, February 1885 to January 1886.
	Royal Academy of Sciences	Oversigt, No. 3 of 1884 and Nos. 1 and 2 of 1885.
CORDOBA	National Academy of Sciences	Boletin de la Academia Nacional de Ciencias en Cordoba (Republica Argentina), Tomo VII, Entrega 3a and 4a; Tomo VIII, Entrega, 1^{e}.
		Anales de la officina Meteorologica Argentina, Tomo IV.
		Actas de la Academia Nacional de Ciencias en Cordoba, Tomo V, entrega segunda.
	Oficina Meteorologica Argentina	Informes Annales y documentus.
DEHRA DUN	Editor, Indian Forester	Indian Forester, April 1885 to March 1886.
	Trigonometrical Branch, Survey of India	Spirit-levelled heights in the Thana, Nasik, and Khandesh districts of Bombay, and in Dhar, Dewas, Gwalior, Bhopal and Tonk Native States of the Central India Agency.
DORPAT	Meteorological Observatory	Anemometrische Scalen für Dorpat.
DUBLIN	Royal Dublin Society	Scientific proceedings, Vol. III, New series, Parts 5 to 7; Vol. IV, New series, Parts 1 to 6.
		Scientific Transactions, series II, Vol. I, Nos. 15 to 25; Vol. II, Nos. 2-3; Vol. III, Nos. 1 to 6.
EDINBURGH	Scottish Meteorological Society	Journal, 3rd series, No. II.
GREENWICH	Magnetical and Meteorological Observatory.	Greenwich Magnetical and Meteorological Observations for 1883.
HAMBURGH	Deutsche Meteorologische Gessellschaft.	Meteorologische Zeitschrift, February to December 1885.
	Deutsche Seewarte	Meteorologische Beobachtungen in Deutschland fiir 1877, 1878, and 1882.
		Monatliche Uebersicht der Witterung, July to December 1884 and the year 1884; January to April 1885.
		Wetterbericht, Vol. X, Nos. 60 to 365; Vol. XI, Nos. 1 to 31.
		Aus den Archiv der Deutschen Seewarte, 1882 and 1883.

Presentations to the Library from the 1st April 1885 to the 31st March 1886—continued.

Place.	Donors.	Title of Work.
HAVANNA	Real Colegio de Belen	Observaciones Magneticas y Meteorologicas, January to June 1876; January to June 1885.
HONGKONG	Observatory	Lunar-Transits across the meridian of Hongkong.
		Report on the height of Victoria Peak.
		Five-day means of the principal meteorological elements for 1884.
		Annual Weather Report for 1884.
		Notice to mariners of the signs of approaching Typhoons.
		Weather Report for August 1884 to November 1885.
		Progressive motion of Typhoons in 1884.
		Observations and Researches made at the Hongkong Observatory in the year 1884.
IOWA	Weather Service	Report of the Iowa Weather Service for September 1881 to December 1882.
		Third Biennial Report of the central station of the Iowa weather service.
		The seasons in Iowa and a calendar for 1884.
		Bulletin of the Iowa Weather Service, January to May 1883.
JEYPORE	Dr. T. H. Hendley	Annual Report of the Jeypore medical and meteorological institutions for 1884.
LAHORE	Government of the Punjab	Report of the Land Revenue Settlement of the Dera Ismail Khan District, 1877 to 1879.
		Volume of maps to accompany the Dera Ismail Khan Settlement Report.
		Report on the Land Revenue Settlement of the Bannu District, 1872 to 1878.
		Volume of maps connected with the Settlement Report of the Bannu District.
	Meteorological Office	Report on the Meteorology of the Punjab for 1884-1885.
LEIPZIG	Augustus Tischner	The fixed idea of astronomical theory.
	Meteorological Institute	Jahrbuch, 1884.
LONDON	G. J. Symons, Esq.	Symons's Monthly Meteorological Magazine, February 1885 to February 1886.
	John A. R. Newlands	The discovery of the periodic law and the relations among the atomic weights.
	Meteorological Office	Principles of forecasting by means of weather charts.
		Quarterly Weather Report, Parts I to IV of 1877.
		Weekly Weather Report, New Series, Vol. I, Nos. 44 to 52; Vol. II, Nos. 1 to 46.
		Monthly Weather Report, November 1884 to August 1885.
		Hourly readings, Part IV of 1882; Parts I and II of 1883.
		Meteorological observations at stations of the second order for the year 1880.
		Report of the Meteorological Council to the Royal Society for the year ending March 1884.
		Daily Weather Report, 1st July to 31st December 1884; 1st January to 30th June 1885.
		Contributions to our knowledge of the Meteorology of the Arctic regions, Part IV.
	Royal Asiatic Society	Journal, Vols. X, XVII, and XVIII, part I.
	Royal Meteorological Society	List of Fellows of the Royal Meteorological Society, 1st February 1885.
		The Meteorological Record, Nos. XV to XVIII.
		Quarterly Journal, New Series, Vol. XI, Nos. 53 to 56.
	Royal Society	Proceedings, Vol. XXXVII, Nos. 233 and 234; Vol. XXXVIII, Nos. 235 to 239.

Presentations to the Library from the 1st April 1885 to the 31st March 1886—continued.

Place.	Donors.	Title of Work.
LONDON—*concld.*	Society of Arts	Journal, Nos. 1686 to 1737.
		Index to Journal, Vols. I to X and XI to XX.
	Solar Physics Committee	Dates of coincidence of the assumed prime meridian of the sun with the central meridian of the visible hemisphere.
MADRAS	Government Astronomer	Madras magnetical observations, 1851 to 1855.
		Singapore magnetical observations, 1841 to 1845.
		Telegraphic longitude determination in India.
	Government of Madras	Annual Administration Report of the Forest Department (Southern and Northern Circles), Madras Presidency, for the year 1883-84.
	Meteorological Office	Administration Report of the Meteorological Reporter to the Government of Madras for 1884-85.
MADRID	Royal Observatory	Anuario, Ano XVIII, 1880.
		Observaciones meteorologicas, 1879 to 1881.
		Resumen de las observaciones meteorologicas de provincias, 1876 to 1882.
MANCHESTER	Literary and Philosophical Society	Memoirs of the Literary and Philosophical Society, 3rd series, Vol. VIII.
		Proceedings, Vols. XXIII and XXIV.
MAURITIUS	Royal Alfred Observatory	Mauritius meteorological results for 1882 and 1883.
MELBOURNE	Observatory	Monthly record of results of observations in Meteorology, Terrestrial Magnetism, &c., taken at the Melbourne Observatory from October 1884 to October 1885.
MEXICO	Central Meteorological Observatory	Boletin del Ministerio de Fomento de la Republica Mexicana, Tomo IX, Nos. 65 to 80; Tomo X, Nos. 1—36, 43—113.
		Resumen comparativo correspondiente a les Anos de 1877—1884.
		Estudios de meteorologiá comparada, Tomo I.
MILAN	R. Osservatorio di Brera	Sui temporali osservati nell Italia superiore durante l'Anno 1879.
MONCALIERE	Central Observatory	Osservazione delle meteore luminose nell' Anno 1884 and 1885.
MUNICH	Geographical Society	Jahresbericht für 1884.
	Royal Bavarian Academy of Sciences.	Astronomisch-geodätische Bestimmungen, ausgeführt an einigen Hauptpunkten des Bayerischen Dreiecksnetzes.
		Nachträge zu den zonenbeobachtungen der Sternwarte bei Munchen.
		Sitzungsberichte der mathematisch physicalischen class, Hefte II to IV of 1884; Heft I of 1885.
		Abhandlungen der mathematisch physicalischen classe, Band X, parts I and II.
NAGPUR	Chief Commissioner, Central Provinces.	Returns of rail-borne traffic during the quarters ending 31st December 1884, and 31st March, 30th June and 30th September 1885.
		Report on the Nagpur Experimental Farm in the Central Provinces for the year 1884-85.
		Report on the railway-borne traffic of the Central Provinces for 1884-85.
		Forecast of linseed crop in 1886 in the Central Provinces.
		Forecast of wheat crop in 1886 in the Central Provinces.
		Review of the Agriculture and Revenue Reports of the Central Provinces for the year 1884-85.
NEW HAVEN	Connecticut Academy of Arts and Sciences.	Transactions, Vol. VI, part 2.
NEW YORK	Meteorological Observatory	Abstract of registers from self-recording instruments, December 1884 and January to November 1885.
		Annual Report for 1884.
OXFORD	Radcliffe Observatory	Results of meteorological observations made at the Radcliffe Observatory, Oxford, in the year 1882.

Presentations to the Library from the 1st April 1885 to the 31st March 1886—continued.

Place.	Donors.	Title of Work.
Paris	Bureau Central Météorologique de France.	Bulletin International, Vol. XXIX, Nos. 58 to 365; Vol. XXX, Nos. 1 to 56.
		Annales du Bureau Central Météorologique de France, Année 1881, Tome IV; Année 1882, Tomes I, III, IV.
		Rapport du Comité Météorologique International, Réunion de Copenhague, 1882.
	Meteorological Society of France	Annuaire, December 1882; April to December 1884; January to April 1885; January 1886.
Perth (W. Australia)	Meteorological Office	Western Australia Meteorological Report for 1884.
Philadelphia	Franklin Institute	Journal, March 1885 to February 1886.
Pola	K. K. Hydrographisches Amte	Meteorologische und Magnetische Beobachtungen, January to September 1885 and November 1885 to January 1886.
Prague	Observatory	Magnetische und Meteorologische Beobachtungen im Jahre 1884.
Rousdon	C. E. Peek, Esq.	Meteorological observations taken at the Rousdon Observatory during the year 1884.
Simla	Inspector General of Forests	Report on Forest Administration in the Chota-Nagpur Division of Bengal.
		Review of Forest Administration in British India during the year 1883-84.
Singapore	Colonial Secretary, Straits Settlements.	Straits Settlements Meteorological Returns for 1884.
St. Petersburgh	Physical Observatory	Annalen des Physikalischen Central observatoriums, Jahrgang 1883.
	Dr. M. A. Woeikof	Les Rivières et les Lacs de la Russie.
		Flüsse und Landseen als Produkte des Klimas.
		Temperaturänderung mit der Höhe in Bergländern und in der freien atmosphäre.
		Die Regenverhältnisse des Malayischen Archipel.
		Etude sur la temperature des eaux et sur les variations de la temperatur du globe.
		Influence of accumulations of snow on climate.
		Klima an der Lenamündung nach einjahrigen Beobachtungen.
Stonyhurst	Stonyhurst College Observatory	Results of meteorological and magnetical observations, 1884.
Sydney	Observatory	Results of rain and river observations made in New South Wales during 1884.
Syracuse	Central Observatory	Osservazioni meteorologiche, Vol. VIII, Nos. 6—12, Vol. IX, Nos. 1—12.
Tasmania	Royal Society	Papers and Proceedings of the Royal Society of Tasmania for 1884.
Tiflis	Physical Observatory	Meteorologische Beobachtungen im Jahre, 1883 und 1884.
		Beobachtungen der Temperatur des Erdbodens im 1882 und 1883.
		Physikalisches observatorium im Jahre 1881.
		Magnetische Beobachtungen im Jahre 1883.
Tokio	Imperial Meteorological Observatory.	Monthly summaries and means for the year 1884, with 41 maps.
		Report of the Meteorological observations in the Empire of Japan for January to May 1884.
	University	Measurement of the force of gravity and magnetic constants at Ogasawara-jima (Bonier Island).
Toronto	Meteorological Office	Monthly Weather Review, January to December and year 1885; January 1886.
		Report of the Meteorological Service of the Dominion of Canada for 1883.
Turin	Osservatorio dell Universita di Torino.	Effimeride del sole, della Luna e dei principali Pianeti calcolati per Torino in tempo medio civile di Roma per l'anno 1886.
		Osservazioni dell'ecalisse totale di luna del 4—5 Ottobre 1884.
		Sulla possibilita che il vulcano Krakatoa possa avere proiettato materie fuori dell' atmosfera.
		Sulla frequenza dei venti inferiori deseinta dalle osservazioni fatti dal 1866 al 1884.
		Bolletino dell osservatorio Anno XIX, 1884.

Presentations to the Library from the 1st April 1885 to the 31st March 1886—concluded.

Place.	Donors.	Title of Work.
Turin—*concld.*	Societá Meteorologica Italiana	Bolletino decadico Ano XIII, Nos. 3 to 12; Ano XIV, 1 to 5.
		Bolletino Mensuale, Serie II, Vol. IV, Nos. 1 to 12; Vol. V, Nos. 1 to 7, 9 and 10.
Upsala	N. Ekholm et K. L. Hagstroni	Mesures des hauteurs et des mouvements des Nuages.
	Observatoire météorologique de l'Université.	Bulletin Mensuel, Vol. XVI, Annee 1884.
		Rapport du Comité météorologique international.
Vienna	Dr. J. Hann	Zeitschrift der oesterr. Meteor. Gessellschaft, Band XX, March to December 1885 and Index.
	K. K. Central Anstalt für Meteorologie und Erdmagnetismus.	Internationaler telegraphischer Wetterbericht, Vol. IX, Nos. 42 to 365; Vol. X, Nos. 1 to 15.
		Jahrbücher, neue Folge, Band XIX, Jahrg. 1882; Band XX, Jahrg 1883; Band XXI, Jahrg. 1884.
	K. K. Geologische Reichsanstalt	Verhandlungen, Nos. 14 to 18 of 1867; Nos. 3—9 of 1868; Nos. 7—10 of 1871; Nos. 3 to 18 of 1885.
		Jahrbuch, Band XVII, No. 4; Band XVIII, Nos. 1 and 2.
Vizagapatam	A. V. Nursingrow, Esq.	Results of meteorological observations recorded at G. V. Juggarow's Observatory, Vizagapatam, during 1884.
Washington	Chief Signal Office	Bulletin of International Meteorology, January to December 1884.
		Monthly Weather Review, January to November 1885.
		Professional Papers of the Signal Service, Nos. 13, 15, 16 and 18.
		Report of the Chief Signal Office for 1883.
		Daily International Meteorological Observations, 1st July to 31st December 1883.
	H. A. Hazen	Determination of air temperature and humidity.
		Tornadoes.
	Smithsonian Institution	Guyot's tables for computing differences of elevation from barometric observations.
	United States Naval Observatory	Results of meteorological observations made at the United States Naval Observatory during the years 1881 and 1882.
Wellington (New Zealand).	Meteorological Office	Abstract of meteorological observations, New Zealand, for the quarter ending December 1884.
Zi-ka-wei	Magnetical and Meteorological Observatory	Bulletin mensuel, April to December and year 1884; January to April 1885.
		Mouvements des couches élevées de l'atmosphère à Zi-ka-wei déterminés par la direction des Cirri.
		Typhoons of the Chinese Seas in the year 1885.
Zurich	Swiss Meteorological Institute	Annalen der Schweizerischen meteorclogischen Central Anstalt, 1883.
		Meteorologische Beobachtungen, January to November 1885.

Purchases for the Library.

American Journal of Science, January 1882 and March 1885 to February 1886.

Annalen der Physik und Chemie, Nos. 3 to 12 of 1885; Nos. 1, and 2, 1886.

Cartes synoptiques journaliéres du temps, le Nord de l'Atlantique et une partie des continents avoisinants; publiées par l'Institut Météorologique Danois et le Deutsche Seewarte, September 1881 to February 1882.

Comptes Rendus de l'Académie Ides Sciences, Vol. XCIX, No. 1; Vol. XCVI, No. 10; Vol. C, Nos. 9 to 26; Vol. CI, Nos. 1 to 26; Vol. CII, Nos. 1 to 8; Tables for Vol. XCIX.

Deutstche Rundschau für Géographie und Statistik, Vol. VII, Nos. 7 to 12; Vol. VIII, Nos. 1 to 6.

Encyclopædia Britannica, Ninth Edition, Vols. XVIII and XIX.

La Nature, Nos. 615 to 666.

Meteorological Register kept at the Hon'ble the East India Company's observatory at Madras for the years 1822-43.

Nature, Nos. 802 to 853.

Philosophical Magazine, March 1885 to February 1886.

Report of the British Association for 1884.

Revenue Meteorological Statements of the North-Western Provinces for the several official years from 1844-45 to 1849-50.

Government of India Central Printing Office.—No. 25 Meteor.—16-9-86.—400.

REPORT

ON

THE ADMINISTRATION

OF THE

METEOROLOGICAL DEPARTMENT OF THE GOVERNMENT OF INDIA

IN

1887-88.

PART I.—GENERAL.

THE present report is divided into two parts. The first deals with the more important general and administrative questions that have arisen and been under discussion during the year. The second part describes briefly the actual working of the department, and the condition of the observatories, and includes extracts from the Administration Reports of the Local Reporters.

The permanent head of the department, Mr. H. F. Blanford, went on furlough on the 1st May 1887. During the remainder of the year I acted as Meteorological Reporter to the Government of India, and Mr. Pedler officiated for me as Meteorological Reporter to the Government of Bengal.

Very shortly after I took over charge of the department, I was asked to submit proposals or suggestions for the more efficient and economical working of the department, and for extending its practical value and usefulness as a centre for collecting and disseminating meteorological statistics and information without sacrificing or impairing the scientific portion of the work of the department to which it had hitherto, in the opinion of Government, been too exclusively confined. These were submitted in the form of a Note to Government together with a memorandum from Mr. Blanford approving in part of the changes and additions suggested in my Note. For various reasons the consideration of the whole scheme of proposals has been deferred for some months. It was, however, found desirable to introduce during the present year 1888 a portion of the changes contemplated in my scheme, and I therefore submitted, in November 1887, a partial scheme, which the Government of India were pleased to approve, and to sanction as a tentative measure, preliminary to the consideration and final adoption of the permanent changes necessary to effect the improvements desired by Government.

The most important of these were:—

(*a*) The discontinuance of the solar and terrestrial radiation observations, except at a few selected stations.

(*b*) The adoption of 8 A.M. as the hour of observation for the observations embodied in the weather telegrams transmitted daily to Simla, Calcutta and Bombay.

(*c*) The tabulation of all the observations hitherto recorded in a form admitting of easy reference, and the calculation of daily averages of air pressure, maximum and minimum temperatures, aqueous vapour pressure, cloud and rainfall.

(*d*) The extension and improvement of the methods of collecting rainfall data for the information of the Government of India, and the adoption of a uniform system of rainfall registration throughout India.

The reasons for, and objects of, these changes are given in the following paragraphs.

(A). ABOLITION OF THE SOLAR RADIATION AND TERRESTRIAL RADIATION OBSERVATIONS.—These observations are open to various objections. The instruments by means of which they are taken are very fragile, and have to be exposed in the open, and hence are peculiarly liable to breakage by hail, wind, &c., and are always very tempting objects to persons with destructive tendencies. Hence the observations were frequently interrupted, and the cost of renewing the broken instruments was found to be considerable.

The instruments are also very unsatisfactory and unsuited for exact measurement. Two instruments, apparently identical in construction, will frequently give different readings under the same circumstances. They also become much less sensitive with use, and the rate at which they lose sensitiveness varies very differently in different instruments. Examples from the observations of recent years, illustrating this defect, are given in the Annual Report of the Meteorology of India for the year 1887, and it is hence unnecessary to quote them here. Consequently, these thermometers are utterly useless for exact measurement, unless they are frequently compared with an invariable standard, and this was quite impossible for the hundred and twenty instruments hitherto in use over the whole of India. Their errors and rate of change at any time could not be ascertained, and hence they stood condemned as unreliable measuring instruments.

Finally, if the observations are to be utilized for the objects for which they profess to be taken, *viz.*, the measurement of the intensity of the solar radiation at and near the earth's surface, and of changes in it, a number of subsidiary observations would be necessary in order to eliminate disturbing actions, *e.g.*, the variable amount of radiation from the earth's surface near the instrument, &c. As this is never done, the observations themselves are probably of little real use for the enquiry for which they are assumed to be taken.

It might perhaps be urged that, if a very large number of observations were taken, and average results were obtained, the errors due to local actions and imperfections of the instruments would mutually compensate and the results would be approximately correct and accurate. I have examined several years' observations, and my own opinion is that the solar radiation observations hitherto obtained are unsatisfactory and of little value even from this standpoint, and that, if any useful results are to be obtained, it can only be by having the observations taken at a few selected stations, and under different conditions from those hitherto in force at the majority of stations in India. I consulted Messrs. Dallas, Hill and Pedler, and all agreed with me that it was desirable to discontinue these observations except at a few selected stations, and Mr. Blanford in his memo. concurred in the proposal. Hence these observations were discontinued with the sanction of Government from the 1st of January 1888, at all except the following stations :—

Aden.
Lahore.
Simla.
Leh.
Rawalpindi.
Murree.
Nagpur.
Pachmarhi.
Rangoon.
Calcutta (Alipore).
Dhubri.
Darjeeling.
Silchar.
Deesa.
Mount Abu.

Poona.
Bombay.
Madras.
Vizagapatam.
Coimbatore.
Wellington.
Lucknow.
Ranikhet.
Roorkee.
Dehra.
Chakrata.
Allahabad.
Jeypore.

(B). THE ADOPTION OF 8 A.M. AS THE HOUR FOR RECORDING OBSERVATIONS FOR ORDINARY DAILY WEATHER TELEGRAMS.—The advantages of this change are as follows :—

First.—The interval between 8 A.M. and 10 A.M. is the time of the day when the telegraphic wires in India are most free from traffic. The weather telegrams of the observations taken at 8 A.M. can hence be more quickly transmitted to Simla than those of observations taken at any other hour, and the great majority of the ninety-eight weather telegrams sent off at present daily from the observing stations be delivered in Simla before 10 o'clock, and the whole, except on extraordinary occasions, before noon. By this change of hour, which was adopted from the 1st of April 1888, the daily weather report is now printed on the afternoon of the day to which the observations refer, instead of on the following day, as has hitherto been the practice. This arrangement practically gives the Government the daily meteorological information supplied by the department from twelve to twenty-four hours earlier than has hitherto been possible, and officials in the Punjab, Madras and Bombay (served by the Bombay mail) 24 hours earlier information by post.

Second.—The Bengal Reporter by this arrangement receives all his urgent daily telegrams for the Bay of Bengal Report, issued daily at Calcutta for the information of the commercial community by 9 A.M. at the latest, and hence is able to prepare his daily report before his daily lectures at the Presidency College, and to issue it before 11 A.M. It is thus placed in the hands of the Calcutta Port Officials and the various subscribers belonging to the Calcutta commercial community at the commencement of the office day, instead of at 4 P.M. or 5 P.M. (or at the end of the office day) as has hitherto been the practice. This change has greatly increased the value of these reports, and is, I am informed, much appreciated by all those interested in them. The necessity for earlier publication was urged by several of the Calcutta newspapers in their remarks on the Balasore cyclone of May 1887.

Third.—The hour suggested, 8 A.M., is one of the hours at which observations of the barometer, wind, &c., are always made on board ships. Meteorological observations are rarely recorded at 10 A.M. at sea, and only under very unusual circumstances. Hence the observations contributed by ships entering the ports of Calcutta and Bombay, and collected by the Calcutta and Bombay Meteorological Offices, have not hitherto been directly comparable with the land observations, as they are taken at different hours. This has deprived them of a great part of their value. One of the minor, but very important, improvements which the department has in view is the preparation and publication for at least two or three years of daily charts of the whole area including India, the Bay of Bengal, and Arabian Sea, as well as the Extra-Indian regions of Asiatic Turkey, Persia, Baluchistan, and Afghanistan, in which several observatories have been already established, and additions will probably be made during the next few years. In these charts the sea as well as the land observations will be duly and systematically entered. In this way a complete record will be obtained of the chief features of the weather, day by day, over the whole (land and sea) Indian area, and be filed for reference and discussion in the Central Office. The published data and charts will also be distributed to all meteorologists who are likely to undertake any investigations respecting the origin, character and variations of the air motion and rainfall of the south-west monsoon period in India, or any other cognate questions. Such investigations will, it may reasonably be expected, eventually throw light on the very important question, as to how far the strength of the south-west monsoon, and the distribution of the rainfall in India, are affected by the meteorological conditions over the sea area. That there are marked differences from year to year is evident to any one who has studied the cyclonic storms of the Bay of Bengal. Experience has shown that the storms of the Bay of Bengal have a fairly well-marked uniformity of character during each south-west monsoon period, but that they differ in character, number and line of march considerably from one year to another. It is possible, if not probable, that the peculiarities or abnormal features over the seas adjacent to India (of which the character of the cyclonic storms is one feature) may have as much to do in modifying the strength and field of the south-west monsoon, as snowfall on the Himalayas, or antecedent abnormal atmospheric conditions in India itself. A most important and necessary step in advance for this enquiry would be the adoption of the same hour for observation on land as on sea, and the preparation of the charts I have suggested.

Although there are several disadvantages attending a general change of hour of observation, the advantages, especially from the utilitarian standpoint of more rapid information respecting storms and earlier issue of storm warnings, are so great as to far outweigh the former. This change was introduced on 1st April 1888 as an experimental measure, and has proved on the whole very satisfactory, and will hence be continued as a permanent feature of the department from the end of the present year.

(C). THE TABULATION OF ALL OBSERVATIONS HITHERTO RECORDED IN A FORM ADAPTED FOR READY REFERENCE AND THE CALCULATION OF DAILY AVERAGES.—It may be premised that a very important principle in Indian meteorology is that the observations of some, if not all, of the elements should be much more accurately taken and recorded in India than in temperate regions. This statement or principle is based on the continuous experience of the last twelve years' work of the department. Many of the meteorological phenomena in India, such as the origin of a succession of cyclonic storms in the same part of the Bay, and their motion along nearly coincident paths and in the same direction (as for example the three cyclonic storms of November and December 1886), the tendency of heavy rainfall to repeat itself over the same area during the greater part, or the whole of the south-west monsoon (as for example South Behar in the year 1886 and the area stretching from the Aravallis across Central Rajputana to the Rohtak, Delhi, Aligarh and Agra districts of the Punjab and North-Western Provinces and also the Central Provinces in the year 1887); the persistence of partial drought, or of almost entire absence of rainfall over large areas throughout an entire monsoon period or throughout the cold weather months in Upper India (as in 1886-87), are all phenomena of so pronounced a character, and on so large a scale, that if we believe in causation at all, it is certain there must have been present, before these prolonged abnormal and persistent periods of drought or of excessive rainfall, abnormal conditions; and if we could gauge and interpret these antecedent conditions, we should have the key to forecasting weather in India on a scale which has as yet not been attempted in Europe. Repeated examination has, however, shewn that these antecedent conditions or abnormal features, as imprinted upon the elements of meteorological observation, are comparatively small in amount in the land area of India, and hence very probably also over the sea area to even a greater extent than on land. In tropical countries it is the regular changes that are large and massive in character, whilst the irregular changes or abnormal features (except in the case of the greater cyclones of the Bay of Bengal and Arabian Sea) are small. Hence one of the chief problems of the meteorologist in India is the investigation of these small, but very significant, abnormal variations. Their determination requires that the normal or ordinary conditions should be known exactly. The careful comparison of the observations of the given day or period with the normal values or means will serve to determine the variations. This comparison is at present only possible roughly. Monthly means have been obtained, but what may be termed the normal or average conditions of each day or week of the year are not yet known. Some of the elements of observation occasionally change very rapidly, as, for example, temperature in Upper India in April and May, and the mean of the month cannot be taken as representing the normal condition at either the beginning or end of the month. Hence the daily report published by the Meteorological Office at Simla should not merely give the actual daily observations of pressure, temperature, &c., but also show how far these differ from the ordinary or normal values of these observations for the day. In this way accurate comparison and observation would go hand in hand. At present the former is not possible, as daily averages, except in the case of rainfall, have not yet been obtained. The Government of India sanctioned the employment of 16 temporary clerks from 1st April 1888 to the end of the year, in order that the data and observations already collected might be suitably tabulated, and daily averages of the more important elements of observations be calculated. The daily report next year will hence give the additional data of the variation of the actual observations from their normal values daily.

(D). THE EXTENSION AND IMPROVEMENT OF THE METHODS OF COLLECTING RAINFALL STATISTICS FOR THE INFORMATION OF THE GOVERNMENT OF INDIA, AND THE ADOPTION OF A UNIFORM SYSTEM OF RAINFALL REGISTRATION THROUGHOUT INDIA.

Rainfall is that element of meteorological observation the knowledge of which is of the utmost importance to Government, planters, merchants, &c. Rainfall is registered at all the meteorological stations, and also at a very large number of divisional and subdivisional stations for the Provincial Revenue Departments. It is of course the simplest of all meteorological observations. Each province established its own method of taking rainfall observations, and the information thus obtained is collected in various ways and published in the Provincial *Gazettes*. A small proportion only of the Revenue rainfall stations, in addition to the meteorological stations, have hitherto contributed rainfall data in various ways to the Central Meteorological Office. Some have reported daily for a part of the year by telegram, others by telegram weekly, and a larger number by post monthly. The information thus obtained by the Government of India of the rainfall in any province, as, for example, Bengal, is meagre as compared with that published in the Provincial *Gazettes*, and insufficient to give an approximately correct view of the distribution and variation of the rainfall district by district. The publication of the information by the India Meteorological Department has also been imperfect and fragmentary. The daily report gives a brief summary of the rainfall of the day, as indicated by the observations at the meteorological stations, and the weekly report a very brief analysis of the rainfall of the week based on the same data and the returns of about 29 selected rainfall reporting stations. The annual reports contain a discussion of the rainfall of the year based on information supplied by about 500 stations, but it is necessarily brief, and appears usually 18 months after the termination of the year to which it refers. It is therefore of little practical use to the ordinary public in India.

The defects of the present system are—

1st.—The paucity and imperfection of the rainfall information communicated to the Government of India, as compared with that received by the Local Governments.

The following table gives the number of stations in each province which report in any way rainfall to the Imperial and Local Governments:—

PROVINCE.	NUMBER OF STATIONS COMMUNICATING TO IMPERIAL.			NUMBER OF STATIONS COMMUNICATING TO PROVINCIAL.		
	Meteorological.	Revenue.	Total.	Meteorological.	Revenue.	Total.
Bengal	19	66	85	14	236	250
Assam	5	10	15	5	53	58
N.-W. Provinces and Oudh	5	43	58	15	241	256
Central Provinces	11	16	27	11	58	69
Punjab	13	31	44	11	167	178
Madras	17	61	78	15	299	314
Hyderabad, Mysore and Coorg	3	34	37	?	?	?
Bombay and States	15	39	54	9	226	235
Berar, Central India and Rajputana	15	53	68	?	?	
Burma	11	20	31	8	22	30
TOTAL	124	373	497	88	1,302	1.390

The current rainfall information supplied to the Government of India is too small in amount to enable a fairly complete and accurate view of the distribution of rainfall and its variations from the normal amount to be obtained for an area which is about ten times as large as the British Islands, and in which the range of variation of the rainfall is very much greater. The annual report on the rainfall of England published by Mr. Symons is, it may be added, based on returns furnished by upwards of a thousand observers.

The largest portion of the rainfall information collected by the India Meteorological Department is published in the Annual Report, which does not at present appear until 12 or 18 months after the termination of the year to which it refers, and in that publication the monthly totals and the variations from the average are given, and not the actual daily rainfalls, so that it gives an imperfect view of the distribution of the rainfall.

2nd.—There is an utter want of uniformity in the hours and methods of rainfall observation over India. In fact the measurement of rainfall was initiated provincially under the Revenue Authorities, and it has never been systematized for the whole of India. The following table gives the hours at which the rainfall is measured at the 497 stations observing and reporting rainfall to the India Meteorological Reporter, so far as it can be gathered from the information filed in the Central Office :—

Hours when rainfall was measured.	Number of Stations where measured.	Measured in Provinces.
Midnight (12 P.M.)	5	Bombay and Madras.
Sunrise	2	Rajputana and Bombay.
6 A.M.	24	Rajputana, Bombay, Punjab, Central India, Bengal, Central Provinces, Berars, Hyderabad, Mysore and Burma.
6½ A.M.	1	Mysore.
7 A.M.	7	Bengal, Central Provinces, Hyderabad, Mysore and Burma.
8 A.M.	1	Hyderabad.
9 A.M.	2	Rajputana and Bombay.
9½ A.M.	1	North-Western Provinces and Oudh.
10 A.M.	26	Punjab, Rajputana, Central India, North-Western Provinces and Oudh, Bengal, Assam, Central Provinces, Madras and Burma.
12 A.M.	19	Madras.
6 A.M. & 6 P.M.	8	Punjab, Rajputana, Assam and Burma.
10 A.M. & 4 P.M.	9	Rajputana, Bengal, Central Provinces, Madras and Burma.
10 A.M. 4 & 6 P.M.	1	Bombay.
10 A.M. 4 & 10 P.M.	4	Hyderabad and Madras.
10 A.M. & 6 P.M.	7	Punjab, Rajputana, Central India, North-Western Provinces and Oudh, Central Provinces, Berars and Bombay.
4 P.M.	16	Punjab, Rajputana, Central India, North-Western Provinces and Oudh, Central Provinces, Berars and Burma.
5 P.M.	4	Rajputana, Central India and Bengal.
6 P.M.	167	Punjab, Rajputana, Central India, North-Western Provinces and Oudh, Bengal, Assam, Central Provinces, Berars, Bombay, Madras and Burma.
6½ P.M.	1	North-Western Provinces and Oudh.
10 P.M.	5	Madras and Mysore.
Different times	1	Punjab.
Hours not registered	186	Punjab, Rajputana, Central India, North-Western Provinces and Oudh, Bengal, Assam, Central Provinces, Berars, Hyderabad, Bombay, Madras, Mysore and Burma.
TOTAL	497	

A striking illustration of the difficulty of having to deal with unsystematized observations came to my notice during the past year. Mr. Blanford some time ago took up the question of the influence of forests on rainfall, and found apparently very strong evidence in the rainfall statistics of the Central Provinces. The results of his investigations were given in the last Administration Report (pages 12 and 13 of the Report for 1886-87). If the rainfall returns of that province for the past 20 years could have been accepted as true, they would have established most conclusively that the extension of forests had been accompanied by a marked increase in the average rainfall of the forest districts, and that these changes stood probably in the relation of cause and effect. The conclusion, if fully established, would have been of great importance. Mr. Blanford, in order to assure himself of the value of the rainfall returns he employed in the discussion of the Central Provinces, wrote to the Chief Commissioner on the subject. The following is an extract from the reply of the Secretary to the Chief Commissioner :—

> "The Chief Commissioner fears that the records of rainfall registered in the Revenue Department of these Provinces for years previous to 1883 cannot be accepted as altogether reliable. At ten of the stations for which you quote figures, the rainfall has been since 1869 registered at observatories in the charge of the Medical Department, but the Deputy Surgeon-General is unable to state whether the pattern of gauge has remained unchanged in those observatories since the year of their transfer to his Department, though it has certainly remained unchanged since 1876. As regards the registration effected in the Revenue Department, it is to be remarked that previously to 1887, the instruments which were used were either the Rurki rod and float, or the square self-registering gauge. In 1877 a number of Symons' gauges were distributed, but in 1883 it was found that a considerable proportion of the gauges in use were of one or other of the old patterns; and, moreover, that registration was frequently effected in a very careless fashion. Since that year (1883) matters have been on a more satisfactory footing, but the statistics which were previously collected would form an unsafe basis for generalization."

Hence one result of the unsystematic registration of the rainfall in the Central Provinces is to postpone the decision of the influence of forests on rainfall in that area for another twenty years. It is only one of the many cases that occur in the Meteorological Department, and to which it is unfortunately more exposed than other Scientific Departments, of the worthlessness of unsystematic observation.

Hence I proposed in my Note to the Government of India :—

1st.—To introduce a uniform system of rainfall registration over the whole of India, and to select some definite hour, for example 8 A.M. or 10 A.M., as the hour for daily measurement throughout India.

2nd.—To increase the amount of rainfall information supplied to the Government of India, and to publish it in a more complete form than at present. The method in which, it was suggested, this should be done was as follows. The unit for the collection of rainfall information should be the district. Daily rainfall observations are taken at the Collector's head-quarters, and at the various sub-divisional stations at which rain-gauges are maintained. The latter returns could be sent at the end of the meteorological week by post to the Collector's office. From this information a deferred telegram (by the aid of the Code in use) could be prepared, which would give the daily rainfall and total rainfall of the week at the head station, the average district rainfall for the week, and the highest and lowest total rainfall for the week in the district. This telegram would not cost more than a rupee, and it would give very full information of the character of the rainfall in that district. It would give the time distribution of the rainfall (as shewn by the daily rainfall at the sudder station), the average rainfall in the district, and the range of variation in the rainfall throughout the district during the week. There are about 255 such divisions (*i.e.*, Collectors' districts or areas corresponding to them) as shewn below :—

	No. of Districts.
Burma	29
Bengal	47
Assam	11
Central Provinces	20
North-Western Provinces and Oudh	49
Punjab	31
Bombay	25
Madras	19
Districts not included in the above	24
Total	255

If the information were received weekly in the Simla Meteorological Office, it could be compared with the normal averages, and the whole information published with a discussion in a compact and simple form weekly, and if possible with a lithographed chart to show the most important part of the information at a glance. This report would take the place, or rather be the expansion of, the present weekly report.

In November 1887 I proposed that, as an experiment, rainfall statistics for the south-west monsoon of 1888 should be collected and published in the manner proposed above. This was sanctioned, and the experience of the first six weeks of the present monsoon has shewn that it is a great improvement, and it will hence probably be adopted permanently from next year.

These are the larger changes which were sanctioned during the official year 1887-88 and were effected either from 1st January 1888 or during the current year.

INDIA DAILY WEATHER REPORT AND CHART.

Shortly after I took over charge from Mr. Blanford a series of improvements were effected in the daily report. The size of the sheet was considerably reduced, and the whole matter published in a more compact form. During the previous two years the preparation of the report had been entrusted almost entirely to the youngest officer in the department. As it is that part of the work of the department which comes most frequently before Government and the public, and is one in which experience is especially valuable, the arrangements for its preparation which were in force when I took over charge were considered to be not altogether satisfactory by Government. It has hence been arranged that in future, except under very exceptional circumstances, and then only during the fair season, the work shall be done either by the Meteorological Reporter himself or by the First Assistant Meteorological Reporter, who has had a lengthened experience and training in such work at the London Meteorological Office. A fuller and more complete summary of the observations is now given in the daily report, the object of this being to enable any one to ascertain without reference to the columns of figures representing the actual observations, all the more prominent and important features and indications of the weather of the previous 24 hours, together with the chief inferences of the probable weather of the next 24 hours, so far as they can be based on the observations and on the experience and knowledge of the officer drawing up the report. This is of no great practical utility at present, except in the case of cyclonic storms, inasmuch as it is not possible to disseminate the knowledge quickly enough to be of value to the agriculturist whom it chiefly concerns. It is, however, a direction of desirable extension, and may form the commencement of an important and useful addition to the work of the department hereafter. While making these changes, I pointed out to Government the desirability of adding a chart to the daily report, as it would convey to the public for whom the report is chiefly intended far more quickly and intelligibly than either figures or words the more important features of the weather, and of the observations sent by telegram and published in full in the daily report. The suggestion was not only approved, but I was asked to submit proposals and make the necessary arrangements for its introduction as quickly as possible. I went down to Calcutta in July 1887 to purchase the lithographic presses, and to arrange for the printing of a sufficient supply of forms containing a blank map of India on which to print the meteorological data day by day. Colonel Waterhouse, Superintendent of the Lithographic Branch of the Survey of India, gave me ready and valuable assistance, and prepared a very neat chart and undertook to make arrangements to supply, as required, the necessary number of forms. It was only possible to arrange for a limited supply at first. Fifty copies of the daily report and chart were issued to the Government officials in Simla and certain selected Government officers elsewhere from the 1st of September 1887 to the 31st of March 1888.

During the cold weather arrangements were completed for the supply of the lithographed chart forms at the rate of 250 copies per diem by Colonel Waterhouse, and the daily report, with a chart, was issued from the 1st of April 1888 to 228 Government officers in all parts of India, and to a limited number of Meteorological Bureaus and authorities in Europe and America.

The daily report and chart in its present form will now compare not unfavourably with those published by the Meteorological Bureaus of England, France, Italy, Algeria, Austria, Germany, Australia, and the United States, which are, so far as I am aware, the only States that issue daily weather reports with charts. The India charts will, I believe, be of unique value to meteorologists as they are the only ones which deal almost entirely with a tropical region. They give in a handy and easily intelligible form the daily changes of weather in a country which possesses the double interest of being mainly tropical, and of being the most striking example of the semi-annual system of meteorological changes known in India as the south-west and north-east monsoons. The following is the summary of the Distribution List as it stood on the 1st of April 1888:—

1.	Government Officers	228
2.	Subscribers in India	0
3.	Meteorological Societies and Departments in Europe or America	24
4.	Distinguished Meteorologists	3
5.	Filed in office for future supply or use	4
	Total printed daily on April 1st, 1888	259

STORM-WARNING SYSTEM.

This work has been carried out during the past year by the Meteorological Reporters at Calcutta and Bombay.

Mr. Pedler's duty at the commencement of the official year 1887-88 was to warn—

(1) Calcutta and the River Hooghly.
(2) Chittagong.
(3) The Orissa Ports including
    False Point.
    Pooree.
    Balasore.
    Chandbally.

Mr. Chambers warned the ports of—

(1) Bombay.
(2) Kurrachee.
(3) Ratnagiri.
(4) Bhavnagar.
(5) Daman.
(6) Karwar.
(7) Vingorla.
(8) Goa.
(9) Kumta.

During the year 1886-87, the question of including under one system the warning of all ports in Burma and Madras as well as the Bengal and Bombay ports was partially dealt with by Mr. Blanford. He drew up and introduced a general system of signals and instructions for their use for the guidance of Port Officers. The Burma and Madras Governments acquiesced in the arrangement, and sanctioned the purchase and erection of the necessary apparatus for hoisting the storm signals. It was intended to assign the duty of warning the Madras ports on the Malabar Coast (Mangalore, Calicut, and Cochin) to the Bombay Reporter, and that of warning the Burma ports and the Madras ports on the Bay of Bengal to the Bengal Reporter. As the Burma ports were provided with the apparatus in the beginning of 1887, Mr. Blanford, shortly before he went on furlough, made the final arrangements for the commencement of the work on that coast, and obtained sanction for the additional telegraphic expenditure required and for the establishment of an observatory at Tavoy. The apparatus for hoisting the storm signals was not ready at the Madras ports until nearly the end of the year 1887. Mr. Pedler warned the Port Officers of Gopalpur, Vizagapatam, Cocanada, and Masulipatam informally during the year 1887 of the existence of all storms in the Bay likely to give bad weather to that part of the west coast on which they were situated.

When I was asked, as Meteorological Reporter to the Government of Bengal in November 1886, by the Government of India to undertake the additional work of warning the Burma and Madras ports, I at once accepted, but pointed out certain difficulties in the way of carrying out the work successfully, and suggested certain changes I considered necessary to place the system on a satisfactory footing. These I was fortunately enabled to deal with during the past year, and to place the complete system of storm-warning for the Burma, Bengal and Madras coasts on what appears to be a satisfactory basis.

The first suggestion I made was the necessity for special arrangements ensuring rapid and certain telegraphic communication between the Calcutta weather office and the distant Port Officers and Observatory Superintendents at the Burma and Madras ports during stormy weather. The necessity for rapid communication I pointed out is much greater in the case of the Calcutta than in that of the Bombay Reporter. The Bombay Reporter is a whole-time officer, and his most distant ports to be warned, *viz.*, Kurrachee and Cochin, are at distances of about 550 miles and 650 miles from Bombay in a direct line. The Bengal Reporter is engaged during a large portion of ordinary office hours at the Presidency College, Calcutta. The most distant ports to be warned by him under the extended system are Moulmein, distant 750 miles, and Tuticorin, 1,200 miles in a direct line. The telegraphic communication between Bengal and Burma is much more uncertain than between Bombay and the other west coast ports, as large portions of the lines run through jungle and very thinly populated districts. These facts appeared to establish that the Bengal Reporter was requested by the Government of India to take up a much larger extension than the Bombay Reporter, and to work it under far less favourable conditions for success, and were the chief reasons I urged for special telegraphic arrangements. Fortunately my remarks were emphasized by the event of the Balasore cyclone in May 1887. During the formation of that storm, and from May 19th, the Bengal Reporter received no telegram from the Diamond Island Observatory, the only one which under the existing system gives certain intelligence of the formation and growth of storms near the Andamans. Hence arose some doubt as to the exact course and the strength of the storm, and perhaps some slight delay in the hoisting of the signals at the Hooghly river stations.

The Telegraph Department recognised the necessity for more rapid communication in the case of the distant Burma and Madras ports, and agreed that ordinary urgent telegrams would not always be sufficiently rapid, as there might be delay in case of pressure of work, such for example as occurred on the Burma lines in the cold weather of 1886-87. After some consideration, it was agreed to give precedence to urgent weather messages during storms and to storm-signal telegrams between Calcutta and the Burma and Madras port offices and the larger and more important Burma and Madras observatories (including Rangoon, Bassein, Moulmein, Chittagong, Akyab, Madras, Masulipatam, Gopalpur, Vizagapatam, and Negapatam). The number of such messages in the course of the year will be very small, and they will hence not interfere at all with the convenience of the public, whilst the concession will generally enable the Bengal Reporter to warn ports on the Burma and South Madras coasts some hours earlier than would otherwise be the case. The concession by the Telegraph Department is hence very valuable, and is the latest instance of its readiness to afford every aid and facility to the Meteorological Department in carrying out this practical and important part of its work.

The extension of the storm-warning system to the Madras coast involved several difficulties which have been as yet only partly solved. According to the proposed arrangement it was intended that Mr. Chambers should warn the Malabar ports of Madras. Mr. Chambers has, however, for many years pointed out that the means at his disposal are inadequate to enable him to warn the Bombay ports effectively and with certainty. As it is a great mistake to assign inadequate means to an officer for the performance of an important duty such as that of warning the ports on a long line of coast of the approach of cyclonic storms, or to continue to entrust the duty to one who expresses periodically his opinion of the inadequacy of the means at his disposal, I went down to Bombay at the earliest opportunity after I took over charge of the Department (*i.e.*, on my return from Simla to Calcutta at the end of October) in order to discuss the subject with Mr. Chambers, and to ascertain his minimum requirements for the performance of his storm-warning duties to his own satisfaction, and the safety of the shipping frequenting the Bombay ports. Mr. Chambers suggested, as absolutely essential, the extension of the number of stations reporting to him by daily weather-telegrams from 11 to 28, and the re-arrangement and slight increase of his office staff, to enable him to deal with the observations more effectively and easily than hitherto. His proposals were practically identical with those originally submitted by him to the Government of Bombay in September 1879, and involved a permanent yearly increase of his annual budget grant for storm-warning work from about R8,800 to R23,000.

The Port authorities at Bombay and the Bombay Government have been apparen ly satisfied hitherto with the present arrangements, as no suggestion had been received up to the end of the official year 1887 from them, urging or indicating the necessity of improvements or calling attention to the insufficiency of the present system.

Some time ago Mr. Chambers, in a letter to Mr. Blanford, expressed his opinion that with the arrangements then in force, the Bombay ports could be more effectively warned from Simla than from Bombay. Mr. Blanford consulted with Mr. Dallas as to the expediency, but although both considered it feasible, Mr. Blanford deemed it advisable for certain reasons not to make the change at that time.

In the beginning of 1887 the Finance Commission, on the score of economy, recommended the reduction of the Western India Reportership from the status of a whole-time to a local appointment, and thus place it on the same footing practically as the other Provincial Reporterships. The final decision was postponed by the Government of India until the end of the year 1887. I received Mr. Chambers' proposals in November 1887, and as they involved a large increase of expenditure, I did not think it advisable to forward them for consideration at a time when economical administration was considered of great, if not of primary importance, more especially as I was unable to recommend Mr. Chambers' scheme, however efficient it might have been when carried out under his direction, as an economical permanent addition to the cost and working of the Department. Mr. Chambers' proposal, it may be stated, involved the transmission of two sets of twenty-eight identical weather telegrams to two different offices (*viz.*, Simla and Bombay), the reduction and tabulation of these telegraphic observations at these two offices by two sets of clerks, and the critical examination of the same observations by two different scientific officers. In other words, the whole of Mr. Chambers' storm-warning work, so far as it related to the tabulation, reduction and examination of the observations, &c., is done daily in the Simla Office. Unless the strongest reasons could be assigned for such an arrangement, it can only be considered an expensive arrangement to have the same work done twice over in two different offices. I could find no reasons of this kind in the correspondence on the subject between Mr. Blanford and Mr. Chambers, and the latter officer had furnished the Government of India with a very strong reason against the extension. The weather telegrams at Bombay had been utilised solely for the purpose of warning the Bombay ports, and Mr. Chambers had himself expressed the opinion that the work could be done as well from Simla as hitherto from Bombay, and therefore, it might be fairly assumed, to the satisfaction of the Port authorities and mercantile public.

It might be argued against the Simla arrangement that it would not be safe for Bombay to rely for its storm warnings on an officer at so distant a station as Simla. Telegraphic communication might be interrupted during a storm, and the warning fail to reach the port. This, however, is a contingency which must be faced in all storm-warning systems, and to which Kurrachee and the other west coast ports excluding Bombay are liable by the present arrangements. European practice is opposed to the system of decentralization which has prevailed hitherto more or less in the India Meteorological Department. For example all the ports in England, Scotland and Ireland are warned from one central office in London. Similarly, in France, all the French ports, Marseilles, equally with Cherbourg and Calais, are warned from a central town—Paris, which is not even a sea port; and all the sea ports of the United States, the Pacific as well as the Atlantic ports, are warned from Washington. The experience of many years, I may add, has shown that the probability of such a failure of communication between Bombay and Simla is very small, and that it may by special arrangements be diminished still further, as the Telegraph Department have shown the greatest willingness to give the Meteorological Department every assistance and facility for carrying out the storm-warning work successfully. The practice of wealthy countries like England, France and the United States suggests strongly the desirability of concentrating that most responsible and onerous work in the Central Office, unless there are special reasons for localizing sub-offices or provincial offices such as exist at present for Calcutta and Bengal.

Mr. Chambers' proposals would have doubtless made his weather-reporting and storm-warning arrangements more satisfactory and perfect than hitherto, but I was unable to recommend them as the most economical as well as efficient arrangement for carrying out the west coast storm-warning work as proposed at that time by Mr. Chambers. Hence, until the future status of the Bombay Meteorological Reporter had been decided, it appeared to be undesirable to bring up the question of this large extension proposed by Mr. Chambers. I asked, therefore, that officer to take up the additional work of warning Cochin, Mangalore and Calicut as part of the Bombay storm-warning system which was introduced in 1879, and he at once consented. The Government of India finally decided in March 1888 to reduce the Reportership for Western India from a whole-time to a Local Reportership with effect from the 1st of August 1888, when the whole question of the storm signal service arrangements will probably demand reconsideration.

The arrangements in force at the end of the official year 1887-88 were hence as follows:—

The Bengal Reporter warned the following ports:—

- (*a*) Bengal ports—
  - Calcutta and River Hooghly.
  - Chittagong.
  - Orissa ports, including Pooree, False Point, Chandbally and Balasore.
- (*b*) Burma ports—
  - Moulmein.
  - Rangoon.
  - Bassein.
  - Akyab.
- (*c*) Madras ports—
  - Bimlipatam.
  - Gopalpur.
  - Vizagapatam.
  - Cocanada.
  - Masulipatam.
  - Madras.
  - Negapatam.
  - Tuticorin.

The Bombay Reporter warned—

- (*a*) Bombay ports—
  - Kurrachee.
  - Bhavnagar.
  - Daman.
  - Bombay.
  - Ratnagiri.
  - Goa.
  - Karwar.
  - Vingorla.
  - Kumta.
- (*b*) Madras ports—
  - Cochin.
  - Mangalore.
  - Calicut.

The warning signals are hoisted at the signal stations of Bengal (*i.e.*, at Calcutta, Chittagong and the Orissa ports) by the direct orders of the Meteorological Reporter of Bengal, and at the Bombay ports, *i.e.*, at Kurrachee, Bhavnagar, Daman, Bombay, Ratnagiri, Goa, Karwar, Vingorla and Kumta, by the orders of the Meteorological Reporter for Western India.

The arrangements for the Burma and Madras ports may be described as follows :—

The Port Officers are responsible for the hoisting of the signals, but are guided by the information sent by the Meteorological Reporters, who have received instructions to telegraph fully, at frequent intervals during stormy weather, details of the storm to the ports it is likely to affect, and to give every information and assistance to Port Officers to enable them to hoist the storm signals as soon as is advisable for the protection of the shipping in their ports. This will usually be sufficient to enable the Port Officer at any port to hoist the storm signals so as to give ample warning to all shipping in the port, but if telegraphic communication between that port and the head-quarters of the Meteorological Office with which he corresponds be suspended, the Port Officer is then instructed to rely upon his own judgment, and to hoist the storm signals from the indications of his barometer, strength of the wind, force of the sea, &c. By these arrangements any collision between the Meteorological Reporter and Port Officer is avoided, and each officer is assigned the duty he is best qualified to perform. To a capable officer on the spot—the Port Officer—is assigned the duty of hoisting the storm signals whenever they appear to be necessary, whilst the Reporter is instructed to advise freely and fully, and give him the more exact and complete information that is obtained by collecting and considering the observations of a large number of stations.

The following is a copy of the arrangements actually adopted for warning the Madras ports, as drawn up by the Port Officer, Government Astronomer, and myself, and approved by the Madras Government :—

1. The arrangements for the communication of information respecting the formation, growth and course of cyclonic storms to Port Officers, necessary for their guidance in hoisting the storm signals, will be carried out by the Meteorological Reporters of Bombay and Calcutta under the general direction of the Meteorological Reporter to the Government of India.

The Madras ports which will be included in this storm-warning system are as follows :—

A.—Ports on the Coromandel Coast—

Gopalpore.
Calingapatam.
Bimlipatam.
Vizagapatam.
Cocanada.
Masulipatam.
Madras.
Cuddalore.
Porto Novo.
Tranquebar.
Negapatam.
Tuticorin.

B.—Ports on the Malabar Coast—

Cannanore.
Tellicherry.
Mangalore.
Cochin.
Calicut.
Beypore.

The Meteorological Reporter to the Government of Bengal (Calcutta) will supply the information and work the system for those ports classed as belonging to the Coromandel Coast, and the Meteorological Reporterfor Western India (Bombay) for the Malabar Coast ports as defined above.

2. Information respecting the first indications of bad weather in the Indian Ocean will be sent by the Bombay Reporter, and of bad weather in the Bay of Bengal by the Calcutta Meteorological Reporter, to the Port Officer, Madras, who will, if he deems it desirable, communicate it to any of the Port Officers subordinate to him.

3. As soon as the existence and probable course of a cyclonic storm in the Bay of Bengal or Indian Ocean has been ascertained by the Meteorological Reporter of Calcutta or Bombay, the Port Officer of each of the ports likely to be affected by the storm will be informed and warned by the Reporter appointed to give such warnings to his port. The warning signal will usually be hoisted immediately or shortly after the receipt of this information. The Meteorological Reporter will continue to keep the Port Officers of the warned ports acquainted with the growth, progress, course and other features of the storm, which will be useful as a guide to them in hoisting, when necessary, the danger signal. The danger signal will be hoisted as soon as the Port Officer considers it advisable to warn the shipping of an approaching cyclone, in order that the masters of vessels may carry out the precautions or follow the directions laid down in the Port Rules of the port where they are lying.

By these arrangements the Meteorological Reporters will transmit information and warnings direct to the Port Officers of Madras, Gopalpur, Bimlipatam, Vizagapatam, Cocanada, Masulipatam, Negapatam, Tuticorin, Mangalore, Cochin and Calicut. At the remaining ports, *viz.*, Calingapatam, Cuddalore, Porto Novo, Tranquebar, Cannanore, Tellichery, and Beypore, where the signals will be hoisted by the Port Conservators, the Port Officer, under whom they are immediately placed, will instruct them by urgent telegrams to hoist the warning and danger signals at the same time that they hoist them at their own ports. By this arrangement information respecting bad weather and directions relating to the hoisting of storm signals will be communicated to the Port Conservator of Calingapatam by the Port Officer of Gopalpur, to the Port Conservators of Cuddalore, Porto Novo and Tranquebar by the Port Officer of Negapatam, to the Port Conservators of Cannanore and Tellichery by the Port Officer of Mangalore, and to the Port Conservator of Beypore by the Port Officer of Calicut.

4. It should be clearly understood that the duties of the Meteorological Reporters of Bombay and Calcutta are confined to furnishing as definite, full, and early information as possible of the character, position, course, probable time of approach and varying phases of cyclonic storms to the Port Officers of all ports to which these storms will probably cause dangerous weather and a high sea. The responsibility of hoisting and taking down the storm signals rests solely with the Port Officers. They will usually be guided mainly by the information received from the Meteorological Reporter; but if that information be insufficient or be delayed in transmission, or if telegraphic communication be suspended by breaks in the lines, the Port Officers will be guided by the indications of the barometer, force of the wind, state of the sea, and general aspect of the weather.

5. A memorandum of storm prognostics will be drawn up by the India Meteorological Office, and a copy be sent (as well as all subsequent additions and alterations) to each Port Officer to assist him in deciding when to hoist the storm signals on the approach of a cyclonic storm, more especially in the case of failure of telegraphic communications.

6. The storm signals to be employed are of two kinds—one for day use, and the second for use at night. They are as follows:—

1st.—Day signals—
  No. I.—Bad weather or warning signal—*A Ball.*
  No. II.—Storm or danger signal—*A Drum.*

2nd.—Night signals—
  No. I.—Bad weather or warning signal—*Three white lights arranged in a vertical line.*
  No. II.—Storm or danger signal—*Two white lights arranged in a vertical line.*

The *Ball* or *three white lights* when hoisted indicates that a cyclonic storm has formed which will probably advance to that part of the coast on which the port is situated, but is still at a considerable distance from it.

The *Drum* or *two white lights* when hoisted indicates that a storm of considerable magnitude is approaching that part of the coast on which the port is situated, and will shortly cross the coast.

7. In order to facilitate and expedite the working of these arrangements, the Telegraph Department has granted the privilege of *Precedence urgency* to telegrams referring to stormy weather and the hoisting of storm signals between the Meteorological Reporter of Calcutta and the Port Officers and Meteorological Superintendents of Cocanada, Gopalpur, Madras, Masulipatam, Negapatam and Vizagapatam. The names of other officers will be added to this list as found necessary

for the proper working of the system. Instructions for the preparation and despatch of the telegrams in proper form, in order to secure priority of transmission to ordinary urgent messages, will be sent by the India Meteorological Office to the various officers permitted to send them.

8. Copies of all telegrams despatched to Port Officers other than the Port Officer, Madras, relating to the approach of cyclonic storms, will be sent at the same time to the Port Officer, Madras, in order that he may be kept fully acquainted with the weather information and instructions communicated by the Meteorological Reporter to the Port Officers subordinate to him.

9. The Port Officer, Madras, will communicate all meteorological information received during storms from the Government Astronomer, Madras, to the Calcutta Meteorological Reporter for his information.

10. Port Officers noting the appearance of suspicious weather before the receipt of any telegram from the Meteorological Reporter co-operating with them, should communicate the information without delay to that officer.

11. All the Port Officers receiving telegrams from the Meteorological Reporters during a storm should send a brief statement, after the cyclone has passed away, of the telegrams received from the Reporter, and of the exact time when they were delivered by the telegraph offices, in order that the Meteorological Department may exercise an effective check over this part of the working of the system, and secure the necessary rapidity of telegraphic communication required for the proper working of the system.

STORM OBSERVATIONS.

Amongst the minor proposals I made to Government, and which are as yet under consideration, was one for securing satisfactory storm observations. Observers have been paid hitherto only for taking the regular periodic observations. They have been urged at various times to take extra observations during storms, but as that work is very irksome, and necessitates exposure to heavy rain, strong winds, and bad weather, and does not entitle the observer to extra pay nor diminish his pay if it be left undone, these observations have been systematically neglected. The observers had of course the excuse that these observations were not only very troublesome, but that they were really not part of their duty for which they were employed and paid. Mr. Blanford, some years ago, in order to improve the position of observers, obtained the sanction of Government to the grant of a number of special allowances of R5 and R10, which were allotted annually to observers for prolonged good service and for accuracy of observation. But in assigning these allowances no regard was paid to the claims of extra observations. They were allotted to observers who, however accurate their ordinary work might have been, never, in the great majority of cases, stepped beyond the limits of the regular work of observation. In meteorological enquiry, accuracy of observation, it would naturally appear, should be considered to denote accuracy of observing the most important facts and features of the weather, and not be restricted merely to accuracy of regular observation of matters which are frequently of comparatively little importance. In this respect our observers have signally failed. To give one or two recent examples. The Balasore cyclone of May 1887 passed close to Hazaribagh. The observer did not take a single extra observation. The cyclone of October 1886 passed near the observatories of Cuddapah, Belgaum and Bellary. In drawing up the report of that cyclone the only observations available for that part of its course were the regular observations and no more.

This aversion to recording storm observations is undoubtedly partly due to the want of interest taken by many of our observers in their work, which makes constant watchful supervision an absolute necessity. The necessity for a change in this direction has been strikingly shown by the experience of the hot weather of the present year. It has been remarkable for the occurrence of some of the most violent hot weather storms or tornadoes of recent years. Among them may be mentioned—

Dacca.
Delhi.
Cawnpore.
Moradabad.
Serampur.
Pubna.

The first of these was exceptionally violent, and passed within a few hundred feet from one of our meteorological observatories. Notwithstanding this, not a single extra observation was taken, nor has any meteorological information been obtained which throws any light on its origin. No special information was received from the observer, except the intimation in the regular daily telegram that there had been a tornado, a statement which is occasionally made by our observers when a somewhat more severe thunderstorm or nor-wester than usual happens. A series of observations taken at brief intervals during the tornado at Dacca would have been of the highest interest, and might have been almost invaluable if they had helped to throw light upon the formation and character of the tornado.

The special allowances have hence failed to arouse the intelligent interest of our observers in their work, such as would have been shewn by the careful registration of observations during storms. I do not think they have even secured any marked improvement in the regular observations, and my experience in this respect is confirmed by that of Messrs. Hill and Pedler. Accuracy of observation has been, and will probably in future be, secured and maintained chiefly by constant scrutiny of the observations, and the rejection of all doubtful ones. The allowances have also given rise to a considerable amount of heart-burning, and those who have once received them think they have established a claim to them for the future, and those who do not receive them, think they ought to have them, and are disappointed at not receiving them. They have also apparently introduced two standards for accuracy of observation—an ordinary standard for which the observer is entitled to full pay, and a higher and meritorious standard for accuracy in the same class of observations (and not for extra observations for which a special reward or payment might naturally be expected) rewarded by special allowances. That the special allowances do not act as a certain stimulus to improved and more accurate work, may be shown by the fact that in several cases it has been found necessary to suspend or withdraw them for brief periods during the past two years.

As they have not effected any of the objects for which they were established and have neither secured extra storm observations, nor improved the ordinary observations, I proposed to Government that they should be discontinued, and the sum thus saved be devoted to payment for extra observations, and the principle has been accepted by the Government. During the year 1888, from April to December, the amount thus saved (R3,000) will be allotted to paying the observers for the extra 8 A.M. observations which are telegraphed daily to Simla. Next year, when these observations, if continued, will form part of the regular and permanent work of the department, the amount hitherto devoted to special allowances, *viz.*, R3,000, will probably be utilized for the payment of observations taken during storms, sent in full to the Calcutta Office, and a brief resumé telegraphed to Simla for the daily report. These storm telegrams, if adopted, will supply valuable information, and remove a serious defect from the present daily report, *viz.*, the absence of information respecting severe storms at the time of their occurrence.

As I have referred to the interruptions of the Diamond Island line, I may state here that I was informed by the Telegraph Department they were mainly due to falling trees. The line runs through a very narrow belt of cleared forest jungle, the belt not being wide enough to prevent trees in high cyclonic winds from falling down and injuring or breaking the line. The Court of Enquiry on the loss of the *Sir John Lawrence* which sunk with about 800 passengers on 25th May 1887 during the Balasore cyclone of 1887, recommended—

(1) That the Diamond Island line should be put into proper order.

(2) That Port Blair should be connected telegraphically with India and weather telegrams be forwarded.

The first of these proposals has been sanctioned and a sufficient width of forest has, I believe, been already cleared to prevent interruption in future from falling trees. The second proposal has been postponed on account of want of funds.

PUBLICATIONS.

The annual report for 1886 was taken up earlier than usual. The whole of it was finished by August 1887, but the printing of so large a volume of tables and numerical matter always requires a long time. The report was hence not ready to lay before Government until January 1888. This was however four months in advance of the publication of the previous annual report. The report for 1886 appeared in the same form as that of previous years and discussed the chief features of the meteorology of the year under the same heads as before.

The charts of the Arabian Sea prepared by Mr. Dallas from the data collected by the Board of Trade from ships navigating that sea during the period 1855—78 were published during the year in exactly the same form as the charts of the Bay of Bengal. This completes the most important part of the work respecting the Indian seas handed over to Mr. Dallas.

Several parts of the Indian Meteorological Memoirs were issued during the year:

The second part of Mr. Blanford's memoir on "the Rainfall of India" was issued in October 1887.

The third part is now complete and is being issued (May 1888).

The fourth part is in the press, and is nearly ready and will shortly be published. This will complete the subject and also the third volume of the Memoirs which will contain the whole of Mr. Blanford's valuable monograph on "the Rainfall of India."

Part IV of Volume IV, giving a list of storms during the years 1882-86 with brief descriptions, similar to the list published in Part VI, Volume II, and intended as a continuation of that list bringing information up to date, and followed by a full account of the three cyclones of November and December 1886 in the Bay of Bengal, was issued in February 1888.

An account of the Balasore cyclone of May 1887 was prepared as the first part of a new publication of the Department, called the Cyclone Memoirs, which form has been adopted with the sanction of the Government of India. It was issued in January 1888.

In addition to these memoirs, the following are in preparation:—

(1) Mr. Chambers' report of the cyclone of May and June 1881 in the Arabian Sea.

(2) Hand-book of Cyclonic Storms in the Bay of Bengal, for the use of sailors, which is nearly ready for the press. It may be mentioned that the greater part of this was ready twelve months ago, but that it was considered desirable to postpone its publication until the question of the permanent adoption of 8 A.M. as one of the hours of recording observations at all stations was settled.

(3) Analysis of the cold-weather storms in Northern India during the period 1876-1888.

The publication of an account by Mr. Chambers of a cyclone which occurred nearly seven years ago, seems to require some explanation. The following states briefly the circumstances:—Mr. Blanford, when the Department was reorganized in 1875, suggested the appointment of a whole-time officer in Bombay instead of a local Reporter as had been done in Calcutta, Allahabad, Madras and the Punjab. His first duties were the organization of the observatories in Western India (*i.e.*, Bombay, Berars, Western Rajputana, and Central India). Afterwards when this work was completed it was intended that he should take part and assist the Head of the Department in carrying out the scientific investigations of the department. Mr. Blanford suggested, some years ago, to Mr. Chambers that he should take up the cyclonic storms of the Arabian Sea. Their chief features were, in Mr. Blanford's opinion, little known, and an investigation would probably result in valuable practical information for sailors, as well as throw light on their origin, and also probably on the general character of the south-west monsoon. The work was postponed for several years, as Mr. Chambers urged that his office was too small to undertake the extra labour of dealing with the storm observations, and that he was himself engaged in other and more important scientific investigations.

The following extracts from orders of the Government of India, dated October and December 1881, show fully the opinion and wishes on the question of the Government at that time:—

> "Some twelve months ago Mr. Chambers was requested by the Meteorological Reporter to the Government of India to prepare a report on past storms which have occurred in the Bombay Presidency. This he has objected to compile, partly because the duty would interfere with the private researches which he is pursuing in connection with a storm-warning system, partly on the plea of insufficient office establishment, and partly through a misconception of the magnitude of the work"; and "the special work to which Mr. Chambers has been directed to turn his attention is a report on past cyclonic storms, and the Government of India sees nothing in Mr. Blanford's requisition which is either unreasonable or incompatible with the performance of Mr. Chambers' ordinary official duties."

In December 1885 Mr. Chambers obtained an addition of two clerks to assist him in his meteorological investigations. During the next year, he contributed nothing to the work of scientific meteorological investigation as published in the Meteorological Memoirs of the Department, or in the direction which Mr. Blanford thought he ought to work. At last, when the question of the future maintenance of the Western India Reportership as a whole-time or a local appointment was under consideration, the Revenue and Agricultural Department of the Government of India, through Mr. Blanford, directed Mr. Chambers, in April 1887, to take up the investigation of the cyclones of recent years in the Arabian Sea and to submit a report before the end of the year 1887. In accordance with this order Mr. Chambers forwarded, on the 27th December 1887, the report on the cyclone of May 1881 in the Arabian Sea. After a reference to the Government of India, it was sent to press, and will be ready for issue during this year.

Barometers.

A question which has come prominently before me whilst doing the daily report work, has been the very doubtful and unsatisfactory character of the barometric observations submitted by many stations. The necessity for the greatest possible accuracy in this element of observation is obvious to any one who has thoroughly realized the extreme smallness of many of the more important barometric indications in India. The reasons for this have been already stated—*vide* pages 4 and 5.

Amongst the more remarkable cases of frequent or lengthened erroneous barometric observations which have come to my notice during the past year I may mention—

(1) Gya.
(2) Rawalpindi.
(3) Thayetmyo.
(4) Rangoon.
(5) Moulmein.
(6) Bangalore.
(7) Cuddapah.
(8) Madura.
(9) Roorkee.
(10) Pachpadra.

It may be premised that when the reduced observations at any station, as published in the daily report, differ very considerably from those of all neighbouring stations, if they do not represent local stormy weather at or near that station, they are almost certainly erroneous. Such erroneous observations sometimes continue for weeks or even months, and may be due to prolonged careless and inaccurate reading of the barometer, or to ignorance of the proper method of reading the instrument or indolence in not adjusting the instrument correctly before reading it, or to imperfections of the instrument which are either not noticed or are ignored by the observer, or, finally, to the inaccurate determination of the height of the barometer above the sea-level. The majority of the stations named above I visited myself, in order to ascertain whether the inferences drawn from the daily report work as to the character of the barometric observations of these stations were correct or not.

In the case of Gya, there is some doubt about the elevation which is under investigation. But the greater part of the discrepancy in the observations of previous years has undoubtedly been due to careless observations, and in part to the employment of an erroneous correction for the index-error of the instrument in use during the past year. The means based on the observations of previous years can hence not be relied on as accurate or useful for comparison.

When I visited Thayetmyo, the regular observer was absent on leave, and I was hence unable to ascertain the error so far as it depended on the observer. The barometer was a good one and in satisfactory condition. Erroneous readings continued to be submitted, and it was only after I had fined the observer on several occasions for inaccurate observations that the cause was ascertained. They were simply due to the Assistant Surgeon, who is the observer, handing over the duty of taking the observations, for which he was paid, to the Compounder, and the latter was careless in doing what was not his duty. There is of course no objection to an observer teaching any one to record the observations and allowing him to take them occasionally, as it has the advantage of providing a substitute in case of illness of the observer, &c., but the observer should assure himself that the observations thus taken are correct.

A similar arrangement between the Assistant Surgeon and Compounder was recently found to obtain at Rawalpindi, and explains many of the anomalous results which have been submitted from that station during recent years.

The cause of the erroneous readings at Cuddapah was quite different. The barometer was a Kew-principle instrument, and extremely sluggish in its action. I took a long series of comparative readings on my visit to that station, and found that its error to the Calcutta standard in a single day varied from ·02″ to ·09″. This explained fully the cause of the erroneous barometric observations which had been submitted for many months from Cuddapah, and to which I had directed the attention of the Superintendent of the Observatory and the Meteorological Reporter, Madras; but without obtaining any clue to the cause. I left one of my secondary standards there, in order that accurate observations might be begun without the delay and risk of forwarding an instrument from Calcutta. In less than two months this instrument was injured so as to unfit it for further use by some mischievous person, and the observer and Superintendent have been unable to ascertain how or by whom it was broken. The barometric observations taken for some time at Cuddapah have been hence utterly untrustworthy, and the monthly means published in the annual report of little or no value.

At Bangalore I found that the observer (drawing R40 per mensem) was careless in his work, and that the barometer was a very unsatisfactory instrument. Its error, as determined some years ago, was ·044″. When Mr. Blanford visited the observatory in 1886, he found the error to be ·079″. I took a series of 24 comparative readings with two secondary standards, and found the error to be ·056″. I did not think it necessary to make a longer comparison, as a barometer with a large and very variable error, such as that of the Bangalore barometer, is utterly useless for the exact barometric observation necessary in India, and should be at once rejected. As at Cuddapah, I left one of my secondary standards. The observations have been more satisfactory, although there is still an apparent excess in the readings reduced to sea-level, which may perhaps be due to the imperfections of the formula employed in India for the reduction of barometric readings to the sea-level or to the peculiar position of Bangalore with respect to the neighbouring hills.

At Madura the mercury in the cistern was coated with so thick a crust of oxidized mercury that it was impossible to read the instrument correctly. The observer's readings and mine differed by very variable amounts. The instrument was in this case also condemned, and another has been sent from Calcutta to replace it.

Similarly, at the remaining stations, almost without exception, the inaccurate observations were found to be due either to instrumental defects or to carelessness of the observer. Thus at Rangoon it was entirely due to the latter. The observer shirked his work, and deputed it to the second observer, who was only paid to assist in taking hourly observations on four days of the month, with the inevitable result that the observations were quite unreliable.

At Moulmein there was some air in the tube, the presence of which the observer was unable to detect.

At Pachpadra the errors during the latter part of the year were very large, and were ascertained by the Superintendent, after the observer's pay had been suspended, to be due entirely to the carelessness of the observer in not carrying out the instructions contained in the *Vade Mecum*. The surface of the mercury had not been adjusted to the fiducial point for months, and was stated to be about a quarter of an inch below its proper level. The barometric observations taken in 1887 at that station are hence utterly worthless, and the means of previous years probably unreliable.

At Roorkee the apparently erroneous observations were found after a long enquiry to be due to a change of barometer, the notice of which was sent to Simla, but apparently never reached the Simla Office. It was only by continued insistence on the inaccuracy of the Roorkee reduced readings by the Simla Office, and after much correspondence with the Reporter for the North-Western Provinces that the cause of the error was finally discovered by the Calcutta Office.

Finally, several of the Bombay stations are provided with Adie's small mountain barometers which hang freely. These appear to be utterly unsuited for accurate work. They are difficult to adjust, and are liable to unknown errors, as the observers, in order to adjust them, occasionally take hold of the cistern to steady the instrument, and hence heat the mercury in the cistern and thus affect the readings. Mr. Chambers has, however, a high opinion of their accuracy, and his observers have now become accustomed to them. I have not therefore thought it desirable to change them, but the use of such instruments in my opinion makes many of the Bombay barometric observations less satisfactory than they would be, if the observers had been originally provided with really accurate instruments.

It is hence almost certain that barometric work, especially in Southern India, is not as satisfactory as it ought to be, and that the preparation of the daily chart enables the Simla Office generally to detect large or long continued errors. It is probably quite up to the average of European work, but in India much greater accuracy is essential.

Hence it is very desirable that—

1st—The same type of instrument should, as far as possible, be used over the whole of India, so that errors due to the comparison of observations taken by different classes of instruments should be eliminated.

2nd—That the instrument should be one, the error of which is small, and not liable to large or sudden changes of error.

3rd—That more frequent inspection and careful comparison of barometers as soon as their readings become suspicious should be made.

4th—That any instrument the error of which has altered in a large or variable manner should be at once rejected.

5th—That all observations which are *primâ facie* probably wrong should be rejected, and if further evidence and examination confirm this judgment, the observer should be fined for taking inaccurate observations.

Perhaps by attention to these points it may be possible to raise the standard of barometric observations over India to the highest level of accuracy.

The question of the best form of instrument for use in our Indian observatories has not yet been fully considered. I hope shortly to arrange for annual or biennial meetings of the Reporters to consider what improvements can be effected either in instruments or in the work of the Department from time to time. If this suggestion be carried out, one of the first questions which I propose to take up is the type of barometer best suited for our Indian observatories.

MARINE WORKS.

No extension has been made in this work during the year. The following gives a statement of what has been done:—

1st.—208 logs relating to the Bay of Bengal were collected by the Calcutta Office.

2nd.—98 logs relating to Arabian Sea were collected by the Bombay and Calcutta Offices.

In addition to this, the Hon'ble Ralph Abercrombie has taken up the question of the relation of the south-west monsoon to the south-east trades, and suggested the collection of cloud observations near the equator in the Indian Ocean. I have endeavoured to obtain the co-operation of seamen on this point.

ACTINOMETRIC OBSERVATIONS.

The actinometric work has been continued at Mussooree during the past year under the general superintendence of Colonel Haig, R.E., Deputy Surveyor General, in charge, Trigonometrical Branch, Survey of India. These observations are chiefly taken in order to supply observations of a special nature for measuring the intensity of solar radiation to the Solar Physics Committee in England. They are forwarded in full to the Committee at regular intervals. No information has been received as to whether the observations are being utilized. It is very doubtful whether they are of any real value for the object aimed at. The amount of cloud is very large at Mussooree during the last seven or eight months of the year (or during a considerable portion of the cold weather and nearly the whole of the rains), whilst in the hot weather the sky and sun are frequently more or less obscured by dust haze. The question of the abolition or reduction of this observatory will probably be considered during the present year.

The following gives an abstract of the actual amount of actinometric work performed at Mussooree during the year :—

MONTHS.	DAILY SERIES.	
	Complete.	Incomplete.
April 1887	1	16
May „	0	2
June „	0	5
July „	0	0
August „	0	0
September „	0	2
October „	8	13
November „	18	3
December „	4	14
January 1888	8	2
February „	0	6
March „	8	7

INFLUENCE OF FORESTS ON RAINFALL, &C.

In conjunction with the Forest Department, the question of the influence of forests on rainfall continues to form an object of enquiry. Meteorological observations have been taken for the past three years in the Ajmere Forests, and sanction has been granted to their continuance for another two years, when the whole of the observations taken during the five years will be discussed and utilized, to ascertain how far the growth of forest influences the meteorological elements of humidity, temperature, and rainfall in that part of India.

A different method has been introduced in the Saharanpore Forest Division during the year. The object aimed at there is to ascertain the effects of fire conservancy on the *raos* of that Forest Division. Twelve representative *raos* between the Ganges and Jumna Rivers have been selected for purposes of observation by the Inspector General of Forests and Conservator of the School Circle, and in each Forest Chowkie a rain-gauge is suitably placed. Five of them are located in the forest of Sakranda, which is neither closed to grazing nor protected from fire. The rainfall measurements will be made by the forest guards, and the returns submitted to the Meteorological Department for critical examination. These observations will probably give a valuable series of data for testing the effect of different forest conditions in modifying the amount of rainfall, and hence also probably throw some light on the general question of the influence of afforestation on rainfall.

ESTABLISHMENT OF EXTRA INDIAN OBSERVATORIES.

One extension which the Department has kept steadily in view for some time is the establishment of observatories in the large area lying between Europe and Northern India, including Afghanistan, Baluchistan, Persia, Arabia and Asiatic Turkey. A number of observatories in these countries suitably located would, if trustworthy observations could be secured, enable the meteorology of India to be linked on to that of Europe. Such an addition would perhaps enable meteorologists to trace the further course of those storms which pass across Central and Southern Europe, and thence disappear in Asia. Observatories have been established, and are in full working order at Quetta in Baluchistan, Bushire in Persia, and Aden in Arabia, and an observatory was opened at Baghdad during the year. The English Meteorological Council have urged the establishment of an observatory at Perim, in order to provide information with regard to weather conditions and currents at the entrance of the Red Sea, which it wishes to embody in a series of charts it is preparing for the use of sailors navigating that sea. The question is now before the Government of India. A supply of instruments has been sent to Meshed on the Perso-Afghan Frontier, and a valuable series of observations will probably be taken in a region of which little or nothing is known. Instruments have also been sent to the Medical Officer, Khar, in Eastern Baluchistan, at the request of the Punjab Government.

SNOWFALL REPORTS AND FORECAST OF THE GENERAL CHARACTER OF THE SOUTH-WEST MONSOON RAINFALL.

Mr. Blanford, some years ago, investigated the influence of heavy snowfall during the winter in the North-Western Himalayas and Afghan mountains upon the rainfall of the succeeding south-west monsoon period. He gave numerous examples which appeared to establish that heavy winter and spring snowfall has, during the past ten years, been usually followed by a retarded monsoon in Upper India, and also generally by scanty monsoon rainfall in that area. The relation thus apparently established was one of considerable importance practically, as it enabled the department to a certain extent to ascertain the existence of conditions previous to a partial or complete failure of the rains in Upper India, which is one of the areas in India peculiarly liable to drought and famine, and hence to forecast the occurrence of drought and therefore of famine. Mr. Blanford, with this object in view, established a system of snowfall reports which, although confessedly imperfect, appear to give a fairly accurate view of the general character of the winter Himalayan snowfall. A *resumé* of these has been published annually (since 1885) by Mr. Blanford, and the most important deductions respecting the probable character of the succeeding south-west monsoon rainfall stated.

The problem of forecasting in May or June the character of the approaching south-west monsoon is one of great interest and of still greater practical utility. The materials at the disposal of the meteorologist in working out the problem are confessedly imperfect. The rainfall of the south-west monsoon occurs chiefly in India, Burma and the neighbouring area of the Indo-Chinese Peninsula, and is due to the advance of a moist current from the Indian Ocean to these areas. The change in India is a comparatively abrupt one. It is not like the hot season, in which, with certain oscillatory features, the leading conditions are slowly established. It is an abrupt transition marked by the rapid advance of an air current of different and opposite characteristics from that which it displaces.

As I have pointed out on more than one occasion, there are probably three main causes which determine the intensity and area of extension of the monsoon current and the distribution of the accompanying rainfall. The first is the conditions over the sea area whence the lower current proceeds, and acquires the vast amount of moisture, the larger proportion of which is precipitated in India. The second is the conditions or abnormal features in the land areas of India, Burma, &c., towards which [the current advances, and over which the ascensional movement necessary for precipitation takes place in an irregular and diffused manner, and gives rise to the general, fairly continuous, and widely-spread rainfall which occurs during the greater part of the south-west monsoon period. The third is the existence of any abnormal features prevailing to the north of India, and more especially over that large and wide belt or area of entirely different conditions from those which prevail in India itself, *viz.*, the Himalayan mountain and snow region, which virtually extends over a length of 1,750 miles, and an average breadth of at least 200 miles. That the third cause does exercise occasionally a powerful effect has been sufficiently established by Mr. Blanford. That the second cause, *viz.*, local variations or abnormal conditions, chiefly indicated by persistent pressure peculiarities, does also exercise a powerful influence in determining the distribution of the south-west monsoon rainfall, has been shewn more or less fully both by Mr. Blanford and myself in the annual reports and in occasional publications of the Meteorological Department. The first cause of variation is undoubtedly quite as effective as the others, although the evidence is as yet very limited, and it is that for which it is most difficult to collect systematic and reliable observations. An attempt has been made for some time to collect data for the Bay of Bengal. No systematic effort has as yet been made at Bombay to collect observations from ships traversing the Arabian Sea.

Hence as there are as yet no available means of ascertaining the actual variations over the sea area which are effective in modifying the strength and character of the monsoon rainfall, the Indian Meteorologist is necessarily obliged to rely only upon his land data. They are confessedly imperfect, but they are all that he possesses, and until he learns how to use the exact data furnished by the land observatories, he will be unable to interpret the more uncertain indications that would be afforded by meteorological observations in the Indian Ocean, even if they could be placed early enough at his disposal to be utilized in forecasting the character of the south-west monsoon.

Hence in publishing the summary of the winter snowfall and the monsoon forecast hitherto based chiefly upon it, I utilized both the second and third methods as fully as the data appeared to warrant, and based on them the following forecast in the first week of June 1887 :—

> " The chief inference of the character of the approaching monsoon deduced from the present and previous meteorological conditions are as follows :—
>
> (1) The general indications are favourable in North-East and North India and somewhat unfavourable in Southern India.
>
> (2) The Bay of Bengal monsoon current will probably be stronger than usual, and give early and abundant rainfall to Northern India, and more especially in Upper India.
>
> (3) The Bombay monsoon current will probably be retarded and perhaps be feebler than usual. It will be late in being established on the Bombay coast, and there is a strong probability that the rains will be more or less deficient in the Poona, Sholapur, Belgaum, and adjacent districts.
>
> (4) Indications are especially favourable to abundant rain in the Punjab and to a less extent in the Central Provinces, and hence it is probable that the high pressure in the Bombay coast districts will be much less influential than in 1876-77, and that it will not do more than slightly retard the Bombay monsoon and diminish the rainfall in the districts above mentioned."

The forecast was in general agreement with the actual character of the monsoon. The south-west monsoon gave, on the whole, abundant rain to Northern India, and more especially to the Central Provinces and to the greater part of the South-East Punjab, East Rajputana, and the western districts of the North-Western Provinces. The rains held off to a certain extent in the Punjab in July, but this was not due to the absence of favourable conditions in the Punjab itself, but to weakness in the two currents, more especially the Bombay current.

The Bombay monsoon current was weak at its commencement and was somewhat later than usual in being fully established on the West Coast. There was an excessive determination of rain to the Central Provinces which received an average of 58·46 inches from 1st June to 30th September, or 12·22 inches more than the normal average of the period.

There was a slight or moderate deficiency during the monsoon months of June, July, August and September over a portion of the Bombay-Deccan represented by Poona and Sholapur, but it was of no great importance, and the whole of the Deccan received favourable rain in October and November.

The following table of the monsoon rainfall of 1887 shows the general character of the distribution of the south-west monsoon rainfall of the past year, and it will be seen that the forecast was in fair accordance with it :—

		June.	July.	August.	September.	Total June to September.
		Inches.	Inches.	Inches.	Inches.	Inches.
PUNJAB PLAINS	Actual, 1887	1·26	5·38	9 71	2·43	18.78
	Difference from normal	—0·83	—0·97	+4·40	0	+2·60
N.-W. PROVINCES AND OUDH.	Actual, 1887	3·66	11·96	15·57	6·05	37·24
	Difference from normal	—1·06	+0 23	+5·45	—0·35	+4·27
GUZERAT	Actual, 1887	6·72	16·66	6·06	1·67	31·11
	Difference from normal	+2·19	+3 74	—2·31	—4·24	—0·62
NORTH BEHAR	Actual, 1887	11·52	7·52	12·79	7·48	39·31
	Difference from normal	+3·01	—5·17	+1·27	—2·52	—3·41
SOUTH BEHAR AND CHUTIA NAGPUR.	Actual, 1887	5·45	11·21	10·70	6·37	33·73
	Difference from normal	—2·16	—1·50	—1·67	—2·14	—7·47
NORTH BENGAL	Actual, 1887	23·90	9·13	13·74	12·01	58·78
	Difference from normal	+6·69	—5·32	—0·43	—1·66	—0·72
SOUTH-WEST BENGAL	Actual, 1887	8·34	12·34	9·86	8·02	38·56
	Difference from normal	—1·86	+0·39	—3·07	—1·11	—5·65
CENTRAL PROVINCES	Actual, 1887	9·20	23·58	17·54	8·14	58·46
	Difference from normal	+0·17	+7·12	+5·31	—0·38	+12·22
KONKAN AND GHATS	Actual, 1887	44·32	57·07	26·91	19·00	147·30
	Difference from normal	+11·18	+4·77	—5·97	+0·12	+10·10
BOMBAY-DECCAN	Actual, 1887	4·83	8·28	3·47	4·51	21·09
	Difference from normal	—0·24	+2·01	—1·24	+0·06	+0·59
HYDERABAD	Actual, 1887	5·53	6·62	8·72	6·50	27·17
	Difference from normal	+0·31	—0·33	+1·37	—0·26	+1·09
CEDED DISTRICTS AND MYSORE.	Actual, 1887	3·88	3·12	5·60	4·96	17·56
	Difference from normal	+0·82	—0·42	+1·20	+0·17	+1·77
CARNATIC	Actual, 1887	2·72	1·34	4·32	3·85	12·23
	Difference from normal	+0·88	—1·02	+0·25	—0·34	—0·32

PART II.—DETAILS OF ADMINISTRATION.

OBSERVATORIES.

At the commencement of the year under report, there were 135 observatories in India and elsewhere, contributing original registers to the Central Office. A new observatory was opened during the year at Baghdad in Asiatic Turkey. The Dehra (Forest School) and Baroda observatories did not contribute any registers during the year. Thus, at the close of the year, there were 134 observatories working in connection with the department. These are enumerated in the following list, which also specifies the class to which they belong. The classes are:—

1st Class, furnished with autographic instruments for pressure, temperature, humidity, rainfall and wind registration, either continuously or at 10 minutes' intervals.

2nd Class, at which hourly observations are recorded on four days in each month and on other days observations are either taken three times or four times during the day. Certain of these observatories are furnished with anemographs for the continuous registration of the wind.

3rd Class, at which observations of pressure, temperature, &c., are recorded twice daily, *viz.*, at 10 A.M. and 4 P.M., and measurement of rainfall is taken at 6 P.M. Certain of these observatories are also provided with anemographs, and also recorded during the greater part of the year an additional set of observations at the local time corresponding to 6 h. 52 m. Washington time. These observations were transmitted to the United States for inclusion in the series of international or synoptic observations published by the Washington Weather Bureau.

4th Class, at which observations of temperature, wind, and rainfall only are recorded.

BENGAL AND ASSAM.

	Class.		Class.		Class.
Calcutta (Alipore)	1st	Chittagong	3rd	False Point	3rd
Dhubri	2nd	Darjeeling	,,	Pedong	,,
Saugor Island	,,	Purneah	,,	Calcutta (Chowringhee)	4th
Tezpur	3rd	Durbhunga	,,	Demagiri	,,
Sibsagar	,,	Gya	,,	Mongpoo	,,
Silchar	,,	Berhampore	,,	Tura	,,
Bankipore (Patna)	,,	Burdwan	,,		
Hazaribagh	,,	Jessore	,,		
Cuttack	,,	Dacca	,,		

NORTH-WESTERN PROVINCES AND OUDH.

	Class.		Class.		Class.
Allahabad	1st	Chakrata	3rd	Gorakhpur	3rd
Mussooree (Surveyor-Genl.'s office)	2nd	Ranikhet	,,	Ghazipur	,,
Agra	3rd	Dehra (Surveyor-Genl.'s office)	,,	Benares	,,
Lucknow	,,	Bareilly	,,	Jhansi	,,
Roorkee	,,	Meerut	,,	Pithoragarh	,,

PUNJAB.

	Class.		Class.		Class.
Lahore	2nd	Murree	3rd	Kailang	3rd
Mooltan	3rd	Sialkot	"	Delhi	"
Dera Ismail Khan	"	Ludhiana	"	Sirsa	"
Peshawar	"	Chamba	"		
Rawalpindi	"	Simla	"		

CENTRAL PROVINCES.

	Class.		Class.		Class.
Nagpur	2nd	Hoshangabad	3rd	Sironcha	3rd
Jubbulpore	"	Seoni	"	Raipur	"
Pachmarhi	3rd	Khandwa	"	Sambalpur	"
Saugor	"	Chanda	"		

BERAR.

	Class.		Class.		Class.
Akola	3rd	Chikalda	3rd	Makhla	4th
Buldana	"	Amraoti	"		

CENTRAL INDIA AND RAJPUTANA.

	Class.		Class.		Class.
Jeypore	1st	Indore	3rd	Sambhar	3rd
Sutna	3rd	Mount Abu	"	Bickaneer	"
Nowgong	"	Pachpadra	"		
Neemuch	"	Ajmere	"		

BOMBAY.

	Class.		Class.		Class.
Colaba (Bombay)	1st	Jacobabad	3rd	Surat	3rd
Belgaum	2nd	Hyderabad (Sind)	"	Malegaon	"
Poona	"	Bhuj	"	Ratnagiri	"
Deesa	"	Rajkot	"	Karwar	"
Kurrachee	"	Sholapur	"		

MADRAS.

	Class.		Class.		Class.
Vizagapatam	2nd	Kurnool	3rd	Madura	3rd
Bellary	"	Cuddapah	"	Calicut	"
Trichinopoly	"	Madras	"	Wellington	"
Gopalpur	3rd	Bangalore	"	Mercara	"
Cocanada	"	Negapatam	"	Mangalore	"
Masulipatam	"	Salem	"	Rajahmundry	"
Secunderabad	"	Coimbatore	"	Cochin	"

BURMA.

	Class.		Class.		Class.
Rangoon	3rd	Kendat	3rd	Toungoo	3rd
Bassein	"	Bhamo	"	Moulmein	"
Diamond Island	"	Mandalay	"	Mergui	"
Akyab	"	Thayetmyo	"		

BAY ISLANDS.

	Class.		Class.		Class.
Cocos Island	3rd	Port Blair	3rd	Nancowry	3rd

EXTRA INDIAN.

	Class.		Class.		Class.
Aden	2nd	Baghdad	3rd	Katmandu	3rd
Leh	"	Bushire	"	Amini Divi (Lakhadives)	"
		Quetta	"		

OBSERVATORIES IN BENGAL AND ASSAM.—*The Alipore Observatory.*—This observatory serves as a general depôt for the verification of instruments, as well as for observations of an experimental character. An important part of its work is the dropping of two time balls at 1 P.M. local mean time for the port of Calcutta. It is immediately superintended by the Reporter to the Government of India, and the establishment is under the charge of the Chief Observer, Babu Brojo Mohun Ruckhit, B.A. The work of the observatory has been fully described in previous Administration Reports (*vide* Report for 1886-87, page 18) and need not be repeated. No change has been made in the establishment of the observatory during the past year.

The autographic instruments consist of a Sunshine recorder, a Kew barograph and thermograph, a Beckley's anemograph, an Osler's anemometer and a Beckley's rain-gauge. During the past year, with but slight exceptions, the instruments have worked well. The interruptions of the photographic records were fewer in number than last year and were all of short duration, rarely exceeding one or two hours.

The trace measurements of the barograph and thermograph have been compared with the eye-readings of the standard barometer and the wet and dry bulbs in the same manner as last year. The object of the comparison was fully stated in the Administration Reports of 1885-86 (page 19) and 1886-87 (page 18), and need not be repeated. The following gives the mean differences for the past three years, and shews that they are almost constant:—

	1885.	1886.	1887.
Mean difference between standard barometer and barograph during year (*i.e.*, Standard Barometer minus Barograph)	+·025″	+·026″	+·027″
Mean difference between the dry bulb in the thermometer shed and the dry bulb trace of the thermograph (*i.e.*; Thermograph minus Shed dry bulb Thermometer) .	+·4°	+·5°	+·6°
Ditto ditto wet bulb	+·6°	+·5°	+·7°

The Sunshine recorder has worked satisfactorily. The observations of ground temperature have been carried on as in previous years.

The number of instruments verified at the Alipore Observatory, during the year ending 31st March 1888, is given below:—

Instruments.	Number.
Barometers	52
Aneroids	15
Dry and wet bulb thermometers	31
Maximum thermometers for air temperature	6
Minimum do. do. do.	21
Do. do. for nocturnal radiation	10
Solar radiation thermometers	20
Carried over . .	155

Instruments.	Number.
Brought forward	155
Boiling point thermometers	2
Sling do.	3
Standard do.	8
Common do.	1
Traveller's maximum and minimum thermometers in pairs	1
Rain-gauges	2
Measure-glasses for rain-gauges	2
TOTAL	174

The following is a return of the instruments received and issued by the Alipore observatory during the past year:—

INSTRUMENTS.	Received.	Issued.
Barometers	50	41
Aneroids	10	17
Dry and wet bulb thermometers	47	31
Maximum thermometers for air temperature	5	8
Minimum do. do. do.	42	32
Do. do. for nocturnal radiation	12	15
Solar radiation thermometers	24	4
Standard do.	25	2
Common do.	1	1
Boiling point do.	2	2
Sling do.	1	3
Traveller's maximum and minimum thermometers, in pairs	1	1
Rain-gauges	2	2
Measure-glasses for rain-gauges	2	2
TOTAL	224	161

The time signals have worked satisfactorily throughout the year. The two time balls at the Semaphore Tower and on the roof of the Port Commissioners' Office were dropped on all days, Sundays and Holidays inclusive. On the days detailed in the undermentioned list, one time ball only gave signal, the other having either failed altogether or dropped inaccurately or was under repair:—

Dates of failure or repair.	Cause of failure.
26th April 1887	Time Ball at the Port Commissioners' Office failed.
27th " "	Ditto ditto ditto ditto.
From 8th April to 9th May 1887	Ditto ditto ditto under repair.
From 26th May to 5th June 1887	Ditto on the Semaphore Tower, Fort William, under repair.
17th August 1887	Time Ball at the Port Commissioners' Office failed.
4th November 1887*	Ditto on the Semaphore Tower, Fort William, dropped late.

OTHER OBSERVATORIES IN BENGAL AND ASSAM.—A list of the observatories reporting to the office of the Imperial Government has been given at page 29. Calcutta (Alipore), Calcutta (Chowringhee), Mongpoo and Pedong are immediately under the Imperial Office, the remainder under the Meteorological Reporter to the Government of Bengal.

The following extracts from the Administration Report of the Bengal Reporter describe the condition and working of the observatories under his charge:—

"The number of observatories in Bengal and Assam from which returns were received in my office during 1887-88 was 52, arranged as follows:—

1 first class.
2 second class.
21 third class.
28 provincial third class.

"This last figure includes Pooree, which was started on 10th August 1887, and which furnished complete observations by telegraph from the 23rd March 1888 for the storm signal service, and also Tavoy, which commenced work on the 20th March 1888.

"INSPECTION OF OBSERVATORIES.—The following stations were inspected during the year:—

By Mr. Eliot, Officiating Meteorological Reporter to the Government of India—

Gya.
Chupra.
Chittagong.
Akyab.

By myself—

Burdwan.
Raneegunge.
Durbhunga.
Bankipore.
Jalpaiguri.
Motiharee.
Arrah.
Darjeeling.
Dhubri.
Kishnaghur.

By my Head Clerk—

Nya Doomka.
Raneegunge.
Bhagalpur.
Burdwan.
Berhampore.
Bankoora.
Purneah.
Maldah.
Midnapore.
Jessore.
Dacca.
Burrisal.
Noakholly.
Comillah.
Mymensingh.
Furreedpore.
Rangoon.
Bassein.
Moulmein
Tavoy.

"DHUBRI was inspected on the 21st March 1888. One of the main objects of the inspection was to arrange for certain extra work to be carried out at that observatory. The condition of the observatory was fairly good. The velocity part of the anemograph was working very freely, the cups revolving with very light winds. The direction part of the instrument was found to work rather heavily, and the actual wind direction of the vane corresponded to the reverse on the dial. The hourly observations, which had hitherto been taken at Dhubri on only four days in the month have been now replaced by hourly observations taken, since 1st April 1888, on three days during each week, and they will be so continued for one year to make up the complete hourly records of Dhubri, and to enable the average values of that station to be deduced with accuracy. The station will, at the conclusion of the year 1888-89, be reduced to third class, with only one observer on the usual allowance.

"SAUGOR ISLAND was not inspected during the year. Mr. Peters, Telegraph Master, continued to be the observer during the whole year, and has furnished very satisfactory returns. The anemograph also worked well, except that the wind-fans became defective and had to be temporarily replaced by fresh ones from a new anemograph lying in the Imperial Office. A new pair of fans is being made to replace the defective fans permanently. The thermometer shed has been repaired.

"AKYAB was visited by Mr. Eliot, Officiating Meteorological Reporter to the Government of India, to decide the question of removing the observatory to a better site, which was necessitated by the erection of a new Telegraph Office building in close proximity to the shed. He states:—

'No very satistactory site near the Telegraph Office could be found, but as it is very desirable to retain the observatory at the Telegraph Office, a new position about as far from the new Telegraph Office as the observatory was from the old office was chosen. The anemometer will be continued at the same site, and the staging for that instrument and the wind-vane will be increased to a height of about 36 feet above ground.'

"BANKIPORE was found to be in good order, except that the wind-vane and the anemometer were badly in want of oil, and the anemometer decidedly dirty.

"CHITTAGONG was visited by Mr. Eliot on the 26th November 1887: He found the instruments in satisfactory condition, except the anemometer, which was very dirty, and in a position where it was hardly possible to get at it easily to clean it. This has since been altered and the instrument thoroughly cleaned.

"DARJEELING was visited by myself on the 28th, 29th and 31st March 1888 to start the new anemograph in a satisfactory manner. It was found that the new Beckley's anemograph (sent on the 1st August 1887 for use at this observatory) had been erected in a very satisfactory manner, and the anemograph house thoroughly repaired. The clock on inspection was found to be working rather slowly and was liable to stop. The latter defect was put right, but the former will take patience to remedy and to make the clock keep exact time. The wind direction part of the instrument was not recording correctly. This was set right. The instrument is now in excellent order. The wind velocity portion of the apparatus is working freely, and the wind direction portion also moves with a slight shift of wind. The traces on the paper are excellent and the instrument should now give very valuable results. The lightning conductor on the anemograph house appears to be in good order.

"PURNEAH was inspected by my head clerk on the 18th and 19th December 1887. He reports:—

'There was no one to take the 16 hours' observations of the barometer on the 18th. The readings of the rest of the instruments were taken by the Jail warder, and not by the observer, in my presence. I found he could not read them to decimals of a degree. The barometer was in order. The anemometer and wind-vane had been shifted to the south-west corner of the jail and were in an unsatisfactory condition and were put right. The rest of the instruments were in good order. It was ascertained that the observer has been in the habit of delegating his duty of recording the readings of the instruments to the Jail Jemadar who could only be expected to do the work in an imperfect manner.' The explanation furnished by the observer for having thus personally neglected to take the observations on the 18th December not having proved to be satisfactory, he was fined half a month's allowance.

"TEZPUR is the worst kept station in Bengal and Assam. Although the observer has had the benefit of an inspection of the observatory by Mr. Dallas in August 1886, the results of the reduction of the readings reported throw great doubts upon their correctness generally. The barometric pressures of Tezpur for the months of January to May 1887, reduced to sea-level, vary to such a very large extent from the corresponding pressure values at Sibsagar and Dhubri, as to show that the observations were incorrectly taken. The wet bulb readings for September and October 1887 had to be rejected as utterly worthless. The observer was warned, and his allowance was suspended from January 1888 till satisfactory readings are received.

"BERHAMPORE, BURDWAN, JESSORE, DURBHUNGA, DACCA AND GYA were all found on inspection to be in excellent order.

"Of the observatories that were not inspected during the year, Silchar, Sibsagar, Hazaribagh, False Point, Gopalpur and Cocanada have worked satisfactorily and sent in accurate returns.

"The Cuttack observatory has improved considerably during the past year.

"PROVINCIAL OBSERVATORIES—The observatories established for the system of the daily provincial reports in Bengal are the following:—

Balasore.
Midnapore.
Raneegunge.
Noakholly.
Burrisal.
Serajgunj.
Comillah.
Furreedpore.
Mymensingh.
Rampore Bauleah.
Dinaegpore.
Rungpore.
Bankoora.
Jalpaiguri.
Bhagalpur.
Chupra.
Motiharee.
Buxar.
Arrah.
Kishnaghur.
Dehree.
Nya Doomka.
Ranchee.
Chybassa.
Bogra.
Maldah.

"They do not furnish returns to the India Meteorological Office at all, and the observations taken at these stations (at 10 A.M.) are utilized solely for the information of the Government of Bengal and its district officers.

"Several observatories of this class have been athorized to report daily (from 1st April 1888) the 8 A.M. observations for the Bay of Bengal weather report. They are Balasore, Burrisal, Midnapore, and the recently started observatories of Pooree and Tavoy. With the exception of Pooree and Tavoy, these stations, and the remainder of the provincial observatories having direct telegraphic communication with Calcutta, submit 10 A.M. observations during the south-west monsoon period by means of telegrams for the Bengal provincial daily weather report, and during the winter months

Cassella pattern instruments are still in use, and at the fourth, fifth and sixth Beckley's instruments. The records from Hazaribagh are fairly complete, but those of Cuttack are very imperfect. The embossed arrows showing the wind direction were very indistinct on several days, and some of the records had to be rejected on this account. The anemograph at Chittagong worked very well during the year except from October 23rd at 8 P.M., up to the 25th at 9 A.M., when the instrument was being cleaned. At Darjeeling the old Beckley's anemograph ceased to work from September 1887, the bed plate having become warped, rendering the instrument useless, as the registering part ceased to act. A new Beckley's anemograph of larger pattern was supplied and was put up in position by the Public Works Department in a satisfactory manner. It began to work from 27th March, but the first workable and complete traces of the instrument date from 5th April 1888."

OBSERVATORIES IN THE NORTH-WESTERN PROVINCES AND OUDH.—A list of the observatories has been given at page 29. Mussooree is immediately under the Imperial Office, and the remainder under the Metorological Reporter to the Government of the North-Western Provinces and Oudh.

The work of the first class observatory at Allahabad was fully described in last year's Administration Report, and is not repeated, as no change was made during the year. The new observatory buildings accommodate the Meteorological Reporter's Office, as well as the observatory establishment.

The following extracts from Mr. Hill's Administration Report for the past year give the most important facts respecting the working and inspection of the observatories in the North-Western Provinces and Oudh during the year:—

"JEYPORE.—This observatory, maintained at the cost of the Maharajah of Jeypore, was under the superintendence of Dr. Hendley for the whole twelve months. It continued to work in its usual efficient manner. The Superintendent has published a report in which it is stated that in addition to the regular observations of the ordinary instruments made four times daily, and also every hour on four days each month, a nearly continuous record is furnished by a Van Rysselberghe meteorograph, and an Osler anemometer. There is also at this station an autographic record of sunshine, and there are records kept of earth temperatures at various depths down to 40 feet, as well as of cloud movements as shown by the nephescope. Dr. Hendley's report also shows that useful records of rainfall and temperature are now made at numerous dispensaries scattered all over the Jeypore territory.

"ALLAHABAD OBSERVATORY.—The self-recording meteorograph of the Allahabad observatory, which was sent to the maker for repairs at the beginning of the year, was only returned a short time ago, and has not yet been set up again. Throughout the year the usual observations were made by eye four times each day, and hourly observations of temperature, humidity, cloud, rain, wind-direction and velocity were made twice a week. The experience of the twelve months shows that hourly observations of all the meteorological elements usually observed might be carried on continuously at less cost than an autographic record can be obtained by the Van Rysselberghe apparatus. The results would also be probably more exact, and the tabulations and reductions could be effected by the observers from day to day. The introduction of costly autographic instruments of delicate and complicated construction into this country of cheap clerical labour seems, therefore, to be a matter of doubtful expediency. The Tower observations of temperature and humidity mentioned in last year's report are still continued, and a part of the saving accruing from the disuse of the meteorograph has been devoted to carrying out similar observations at two greater heights on the Muir College Tower.

"The Sunshine recorder worked continuously, with the exception of two days in June.

"Earth temperature observations at various depths down to nine feet were made as in the previous year, and transmitted every month to the Calcutta Office for publication in the annual meteorological report. The movements of the upper clouds were also noted when such clouds were visible.

"*Third class observatories.*—The remaining observatories, which now all rank in the third class, that is to say, at which, as a rule, only two regular sets of observations are taken daily, continued to work as usual, though in some respects their working was less satisfactory than in former years.

Those at Lucknow, Bareilly, Ranikhet and Pithoragarh were inspected by me in the summer vacation; those at Sutna and Benares in August and September respectively, and those at Jhansi and Nowgong in the Christmas vacation. Mr. Eliot also inspected the observatories at Sambhar and Ajmere. Of the nineteen observatories reporting to my office, therefore, only six were unvisited by an officer of the Meteorological Department during the year; *viz.*, those at Chakrata, Dehra, Meerut, Agra, Gorakhpur and Ghazipur; and of these six the three at Dehra, Meerut and Ghazipur are voluntary or independent institutions.

"At the time of inspection the observatory buildings, instruments, books and papers were, as a rule, found in good order, and most of the observers appeared to be efficient, attentive and punctual.

"At Jhansi, the instruments were moved with the dispensary on the 14th June to a temporary location at the Rani's Gardens in the city, where the exposure of the thermometers and rain-gauge is not as good as could be desired, but no better site was at the time available. In setting up the wind-vane on the roof of the palace, a mistake of two points was made in orientation, and this continued until the time of my visit in December. I found also that the nominal observer was not in practice the actual observer, and that he could not read the barometer correctly. On my representing this to the Superintendent, Compounder Ashraf Ali, who had been actually taking the observations for some time, was appointed as regular observer.

"At Ranikhet, the thermometer shed was found in bad repair, but that has since been remedied. The anemometer was worn out and had to be replaced by a new instrument. The observer, Jewa Nand, for a long time sent in returns in which the readings of the nocturnal radiation thermometer were absurdly low, the instrument being evidently out of order, and for this his special good-service allowance of Rs. 10 per month was stopped from September to the end of March.

"The observer at Bareilly, Sunder Lal, was dismissed in December for the insolent manner in which he protested against the infliction of a fine for sending in erroneous readings of the mimimum thermometer. The instrument had got broken by some accident, and, in consequence of the loss of some of the spirit, its readings were erroneous to the extent of upwards of 20° for upwards of a month. But the observer never noticed the error nor reported it. Small fines were inflicted on the observers at Gorakhpur, Chakrata and Ajmere."

OBSERVATORIES IN THE PUNJAB.—The observatories in this province are the same in number and position as in the previous year, and are enumerated on page 30. Chamba and Kailang are immediately under the Imperial Office and the remainder under the Meteorological Reporter for the Punjab.

The following extracts from the Administration Report of the Punjab Reporter give briefly the chief facts of the condition and working of these observatories.

"At Lahore the Superintendentship of the observatory has changed hands, Mr. J. C. Oman having proceeded on long furlough. He was succeeded by Dr. Dickson, Superintendent of the Central Jail, who carried on the duties from 11th April 1887 till the close of the official year.

"Observations of the sun and grass radiation thermometers have been discontinued from 1st January 1888 at all the Punjab stations, except Rawalpindi, Murree, Lahore and Simla.

"The synoptic observations undertaken at Lahore for the United States Government have also been discontinued.

"The following observatories were inspected during the year:—

Mooltan.
Dera Ismail Khan.
Peshâwar.
Râwalpindi.
Siâlkot.
Lahore.
Simla.
Delhi.
Sirsa.

The first five stations were inspected by Babú Jaspat Râi, Head Clerk and Chief Observer at the Lahore Observatory, the last four by myself.

"Of Mooltan there is little or nothing to say. Dera Ismail Khan, as on the occasion of my own visit in the previous cold weather, was not in a satisfactory condition. The instruments again showed that proper care and attention were not given to them. Peshâwar at the time of inspection was, as it has always been found, in exceedingly good order. Large buildings are, however, being erected in the neighbourhood of the observatory;—changes which may perhaps seriously affect the temperature and wind observations.

"At Rávalpindi the barometer was out of order, and since the visit of the Inspector this instrument has been replaced by another sent from Calcutta. The pressure observations from this station have long been peculiar, but whether this result is due to defective instruments, as was the case at the time of inspection, or to other causes, has not been ascertained.

"At Siálkot and Lahore the condition of the observatories was quite satisfactory.

"At Simla there has been no change in the site of the observatory. The shed is on the southern slope of a hill, and is exposed to a large amount of radiation from surrounding objects, walls, &c., hence the temperature observations and means are higher than would be anticipated. Also, owing to the unfavourable position of the observatory, it is not possible to expose an anemometer under anything approaching favourable conditions, so that no estimate of the wind force is received from that station.

"At Delhi and Sirsa there has been no change with respect to the observatories.

"At the request of Dr. Alcock and the Deputy Commissioner of the Deraját Division, meteorological instruments have been sent to the Trans-Indus stations of Khar, Rukni and Kingri. Returns from these stations have not yet been received, but it is hoped that these frontier observations will help to throw light on the obscure problem of the formation and advance of the cold-weather storms on which the agriculture of the Punjab so much depends.

"At Lahore, two of the self-registering instruments, *viz.*, the rain-gauge and the sun thermometer, are now in position, and both are working satisfactorily. The other instruments have been received in Calcutta and are about to be forwarded to Lahore. The work of setting up these instruments has devolved on the Superintendent of the observatory, Dr. W. P. Dickson, and it is due to his care that satisfactory results have already been obtained. The exposure of the dry and wet bulb thermometers will require some structural alterations in the observatory building, but I hope these will be carried out at small cost, and when completed the Lahore observatory will be raised to the first class, and continuous records of all the meteorological elements will be registered there. In consultation with Mr. Hilton, Executive Engineer, general details of the anemometer tower have been decided on, and the work will shortly be commenced.

"The inspections carried out by Bábu Jaspat Rái were very carefully performed, and his notes on the condition of the observatories and instruments show that he has carried out this duty in a thorough and pains-taking manner."

OBSERVATORIES IN THE CENTRAL PROVINCES.—The observatories, enumerated on page 30, remained the same as in 1886-87, but that at Sironcha, which had been closed from the 8th November 1886, was, on the return of the observer from leave, re-opened on the 8th April 1887. The observatory at Pachmarhi was reduced from the 2nd to the 3rd class from 15th May 1887.

All these send their registers to the Imperial Office.

During the year the Sanitary Commissioner inspected the observatories at the following stations:—

Nagpur.
Pachmarhi.
Jubbulpore.
Seoni.
Khandwa.
Raipur.
Hoshangabad.
Sambalpur.
Saugor.

The following brief extracts are taken from the inspection report of the Sanitary Commissioner:—

"SAUGOR.—The barometer has been shifted during the year to a masonry building originally used as a sentry box. The instruments were all in good order. New railings have been put up round the observatory shed, and the rain-gauge and grass radiation thermometers exposed in more suitable places.

"KHANDWA.—The shed and barometer house were in good repair, and the instruments clean and in good order. The observer read correctly."

"JUBBULPORE was inspected on 31st August. The shed was in good repair. The instruments were in good order and well kept. The wind-vane and anemometer are somewhat sheltered by trees.

"HOSHANGABAD was visited on 4th October. The shed was somewhat out of repair. The instruments were all in good order. The observer can read the instruments correctly but is reported to be lazy.

"PACHMARHI was reduced from a second class to a third class observatory from 15th May. This change was necessitated by the gross carelessness and inaccuracy of the first observer who was dismissed on the reduction of the observatory, and the second observer appointed to be permanent observer. The shed was found to be in good repair. The barometer is placed in the Record-room of the Kutcherry, to which there is general access and is hence liable to interference and injury. The anemometer was not rigidly fixed, and hence vibrated very much in high winds.

"SEONI, RAIPUR and SAMBALPUR were found to be in efficient working order, and the instruments clean and in satisfactory condition.

"The observatories at Chanda and Sironcha were not inspected during the year. The observations submitted, with the exception of the barometric readings at Chanda, harmonized with those of neighbouring stations and hence were satisfactory."

Nagpur was inspected by myself in February 1888. The situation of the observatory and exposure of the instruments are satisfactory. The barometer is in good working order. A series of comparative readings with a secondary standard extending over two days showed that the index error of the instrument was —·014″ and not —·007″ which was its amount when issued in January 1877 from Calcutta. The thermometers were all in good order. The anemograph was well exposed and in good working order.

OBSERVATORIES IN BERAR.—These are five in number, and are enumerated on page 30. One of them, Makhla, a 4th class observatory established and carried on by the Forest Department, sends its registers direct to the Imperial Office, and the remaining four are under the Sanitary Commissioner, but send in their registers to the Meteorological Reporter for Western India.

Akola was inspected by myself in February 1888. The shed was in excellent repair. The thermometers were in good order and very clean, and the anemometer well exposed and in good condition. The observer is very neat in all his arrangements and ranks amongst the best of our observers.

The remaining observatories were not inspected during the year. The office comparison of the observations taken at these stations during the year shewed that they were satisfactory, and probably accurate.

OBSERVATORIES IN CENTRAL INDIA AND RAJPUTANA.—These are the same as in previous years, and are enumerated on page 30. The Maharajah's observatory at Jeypore, which is a first-class observatory, sends its registers to the Meteorological Reporter to the Government of the North-Western Provinces and Oudh. A brief description of the work done at that observatory, taken from Mr. Hill's report, is given on page 36. Of the remaining observatories, Nowgong, Sutna, Ajmere and Sambhar are under the Meteorological Reporter for the North-Western Provinces and Oudh, and Neemuch Indore, Mount Abu and Bickaneer under the Meteorological Reporter for Western India. Pachpadra sends its registers direct to the Imperial Office.

The observatory at Mount Abu was inspected by Mr. Chambers, Meteorological Reporter for Western India, in March 1887; Sutna by Mr. Hill, Meteorological Reporter to the Government of North-Western Provinces and Oudh, in August 1887, and Ajmere and Sambhar by myself in October 1887.

The Neemuch Observatory has been in a very unsatisfactory condition during the past year. The observer is ignorant and careless, and has made a very large number of mistakes in his observations during the year. As it is apparently hopeless to expect trustworthy observations from the present observer, it will probably be necessary shortly to remove the observatory, and place it on a different footing.

The Sutna Observatory was at the time of Mr. Hill's visit in a very efficient state.

The Ajmere Observatory has improved slightly during the past year, and was in very fair condition at the time of my visit. The instruments were clean and in good order. The observer appears to be attentive, but is by no means intelligent, and makes occasional stupid mistakes which render his work less trustworthy than it ought to be.

The observatories at Nowgong, Indore, Pachpadra and Bickaneer have not been inspected during the past year.

The barometric observations at Pachpadra during the past year, as stated in page 22, were utterly worthless. The Sambhar and Abu observations were on the whole satisfactory.

OBSERVATORIES IN BOMBAY.—These, excepting the Colaba Observatory, are all under the Meteorological Reporter for Western India and are enumerated on page 30.

The condition and working of these observatories during the past year is fully shown by the following extracts from the Administration Report of the Meteorological Reporter for Western India :—

"No new observatories have been established, but a new and complete set of instruments has been issued to the Zanzibar Observatory. Observations ceased to be recorded there in January 1885, in consequence of the death of Dr. Williams, the Agency Surgeon, but there is now a prospect of the work being resumed under Dr. Charlesworth the newly appointed Agency Surgeon. Dr. Charlesworth had already recommenced the observations in December last, but they have since been interrupted by the sale of the building in which the meteorological instruments had been placed, and cannot be resumed until another suitable place has been found for them. No observations have been received during the past year from Mr. K. M. Joglekor, Head Master of the Sirdar's High School, Baroda, who, under the sanction of Government, was furnished with a complete set of instruments in 1883. * * *

"*Anemographs*—The large Beckley's anemograph at Deesa has been kept in continuous operation throughout the year, except on one day, when the observer forgot to lower the pencil on the paper. The similar instrument at Belgaum has produced continuous traces, except on three days, on one of which the clock stopped, and on two of which the trace was obliterated by excessive dampness of the atmosphere. The embossing anemometer at Poona has worked continuously except for a few hours on each of two days, when the instrument was being cleaned and re-adjusted. This instrument is now much worn and fails to record the wind arrows in a satisfactory manner. The similar instrument at Ratnagiri has failed to produce records on 17 days, on five of which the clock was out of order and on twelve of which the strip of paper on which the record is received was spoiled, chiefly by wet weather. * * *

"OBSERVATIONS.—The observations recorded throughout the year at Akola, Belgaum, Jacobabad, Buldana, Chikalda, Indore, Deesa, Bhuj, Mount Abu, Karachi, Sholapur, Ratnagiri, Malegaon, Karwar and Poona are, I believe, thoroughly trustworthy. At Neemuch the anemometer was out of action and under repair for about three months. No barometric observations were recorded at that station in September and October, because the instrument became deranged, and two others forwarded to supply its place were put out of order either during transit or after arrival at the station At Amraoti the barometric observations were untrustworthy from about the 26th April to the 29th May, during which time the work had been entrusted to an incompetent man in the absence of the regular observer on leave. At Hyderabad the anemometer was out of order from the 11th July to the 23rd August, and most of the barometric observations during September had to be rejected as untrustworthy owing to carelessness or neglect of the observer. At Calicut, also, the barometric readings from the 21st December to the 9th January were untrustworthy and were rejected owing to the same cause. In these cases the observers were punished for their neglect and they afterwards improved. At Surat, the barometric observations were unreliable during the greater part of January partly because the observer was absent on sick leave, and his substitute had no experience, and partly from a defect in a new instrument which misled the observer. * * *

"INSPECTION OF OBSERVATORIES.—During the year I have inspected the observatories at Sholapur, Poona, Surat, Mount Abu, Karachi, Hyderabad and Jacobabad. * * The observatories at Poona and Sholapur were in good order and the observers read the instruments accurately.

"SURAT.—The scale of barometer No. 22 was very dirty, and the glass cistern was very much obscured by oxidation of the mercury, but the zero point could still be seen, though not without difficulty. * * * On account of the obscurity of the glass cistern of barometer No. 22, another new instrument by Casella, on the Kew principle, No. 1373, had been supplied to the observatory, but I found this instrument reading about four-tenths of an inch too high, and was informed that the reading scarcely ever changed from 30·4″. I consequently took off the outer brass tube, and then found a large bubble of air breaking the column of mercury in the contracted part of the tube which accounted for the high reading. * * After much shaking, the air was all expelled from the upper part of the tube above the air trap. * * * Afterwards it was fixed properly in position and compared with the standards. The results showed a fall of — ·031″ since the instrument was compared in Bombay before issue, most of which fall is probably due to some loss of mercury from the cistern. * * * The observer evidently does not take much interest in his work, for although he is a competent observer, and can take and record all the observations with great accuracy, everything had a dirty, neglected appearance, and I found numerous small defects.

"MOUNT ABU.—This observatory was inspected on the 1st February 1888. The erection of a new thermometer shed of the standard pattern had been completed only a few days before, and all the thermometers had been transferred to it. They were all in good order. * * After comparing the barometer with the standard instruments, I dismounted it, cleaned the cistern and filtered the mercury, after which it looked as good as new. The comparisons show that the index error had remained constant.

"KARACHI.—This observatory was inspected on the 15th March 1888. The barometer and all the thermometers were in very good order. So was the rain-gauge, except that the cylinder was stuck fast in the foot. * * * The observer was Minguel A. Fernandez. His readings of the instruments were taken very accurately, and his work was neatly and well-done.

"HYDERABAD.—I inspected this observatory on the 18th March 1888. The old barometer, No. 32, was in good order, except that the scale was dirty. The glass cistern was however clean and the zero point was easily seen. * * The thermometers were in good order.

"JACOBABAD.—It was in much better order than the one at Hyderabad, the observer (Shaik Ali) being a much more competent and a more careful man. The barometer and thermometers were all in good order."

OBSERVATORIES IN MADRAS, MYSORE AND HYDERABAD.—Of the 21 observatories in these provinces enumerated in the list on page 30, all but five, *viz.*, the Madras Observatory and those of Gopalpur, Vizagapatam, Cocanada and Calicut, are under the control of Miss Pogson, Meteorological Reporter to the Government of Madras. Ten of these observatories have been inspected during the year, of which nine were visited by myself.

The following extracts from Miss Pogson's Administration Report give the more important facts respecting the condition of the observatories that were inspected during the year.:—

"BANGALORE.—Mr. Eliot inspected the observatory on the 18th of February 1888, in order to find out the cause of the anomalous readings of the barometer, and reported as follows:—

'The barometer is placed in a small room of the Bowring Hospital which has hitherto served as the office room of the observer. A long comparison was made by myself, and the instrument (a small one with narrow tube and oxidized mercury) was condemned and replaced by No. 816 Casella. The observer read the instrument correctly. The thermometers were all in good order and fairly clean. The exposure of the anemometer and wind-vane was satisfactory. The anemometer was filthily dirty. I had to spend upwards of an hour cleaning it, and instructing the observer how to clean it. He was ordered to clean it thoroughly once every month for the next six months, and until the instrument is quite clean in every part. The observer can do his work well but is careless and apparently indolent.'

"BELLARY.—Inspected by Mr. Eliot who reported as follows:—'Observatory was formerly (up to 1886) near the town, in the compound of the old Municipal Hospital. The position was changed in that year to the compound of the new Civil Hospital, opened in 1886. It is in very open ground, behind a small hill of granite to the east of the Railway Station and Telegraph Office. The present position of this observatory is on the whole satisfactory. The barometer is a large Casella's Fortin instrument, No. 852. It is in good order, and the mercury surface in the cistern is quite clean. It was brought into use a year ago. The thermometers were in good order except the minimum, the column of which is very liable to break. The wind-vane and anemometer are on the roof of the hospital, and were in good order. Their exposure is very good.'

"COCHIN.—The old barometer was replaced by a new one, No. 1364 Casella, sent direct from Calcutta on the 26th of September 1887. Comparative observations were taken of the old and new instruments before the former was dismounted by the third assistant of the Madras office, who was sent to unpack and erect the new barometer.

"COIMBATORE.—This observatory was inspected by Mr. Eliot on the 22nd of February 1888, who reported as follows:—'Observatory is in the grounds of the Municipal Dispensary in the midst of the town in a not very satisfactory locality. The streets are broad, and fringed with many cocoanut and other palm trees. The immediate neighbourhood of the town is flat, but to the north and north-west rise the Neilgheries, and to the south the Anamalai Hills. The shed is in fairly good condition. The barometer is in good condition and the mercury surface fairly clean. A comparison showed that the index error is practically changed. The dry and wet minimum thermometers were both out of order. The columns were restored and instructions left as to future use of these two instruments. The wet minimum was thickly encrusted. The wind-vane and anemometer are exposed on the end poles supporting the shed, and the latter is approached by a ladder. The situation and exposure of the anemometer is not satisfactory.'

"CUDDAPAH.—This observatory was inspected by Mr. Eliot for the purpose of determining the cause of the anomalous barometer readings. He reports:—'The observatory is in the compound of the Municipal Dispensary. The ground in the neighbourhood is flat and devoted chiefly to rice cultivation by means of numerous tanks. About 5 miles to the east is the Palkonda range of mountains, running north and south, and rising about 1,000 feet above the plains. The dispensary is surrounded with trees, and the exposure of the observatory is hence not satisfactory. The barometer in previous use was a Kew principle No. 1277 by Casella. A series of readings were taken which showed that its error was not only very variable, but differed very considerably from those of previous determinations. The instrument was therefore condemned and replaced by Casella Fortin's No. 1362. Comparative readings were ordered to be taken for some time, in the hope that the law of error of the old instrument might be ascertained. The thermometers were all in good order. There was a very slight encrustation on the wet minimum. There is no anemometer or wind-vane. Arrangements were proposed by Mr. Blanford on his visit in 1886, but have not yet been carried out. The erection of the staging for the anemometer and wind-vane was delayed through want of funds to meet the expenditure.'

"KURNOOL.—This observatory was not inspected during the year, but the observations appear to have been carefully taken. The staging for the anemometer and wind-vane still awaits sanction and provision of funds for its erection.

"MADURA.—This observatory was inspected by Mr. Eliot to determine the cause of the anomalous barometric readings. He reported as follows:—'The shed was clean and in good order. The barometer, No. 1403, Adie, was placed in the operation room of the dispensary. The mercury surface in the cistern was much oxidized, and as I was hence unable to take satisfactory readings, I left the comparison to be made by the observer. The instrument should be replaced by a new one of standard type at the earliest opportunity. It was removed during my visit to another and more suitable room, but a cage is required to protect it.* All the thermometers were clean and in good order.'

"MANGALORE.—This observatory calls for no special remarks beyond a few words of praise for the creditable manner in which the work has been conducted by the Port Officer's clerk. The register was continuous, and the instruments appear to have been in perfect order throughout the year.

"MASULIPATAM.— There has been a decided improvement in the general working and condition of this observatory throughout the past year. As the thermometer shed was not sufficiently protected from cattle, a peon from the Madras office was sent with suitable fencing-posts and iron bars which were put up under his supervision. The observer's work has been satisfactory."

"MERCARA.—The one year's series of comparative observations at the old and new observatory sites was completed on the 31st of December 1887, and the work of observation at the Telegraph Office observatory was discontinued from that date. The records of the instruments at the Telegraph Office were used for the ordinary register and weather messages up to the 31st of May. From the 1st of June to the 31st of August the barometric readings at the Civil Dispensary of Fortins barometer, No. $\frac{57}{1878}$, Adie, and the thermometric readings of the Telegraph Office instrument were used, and from the 1st of September the readings of the same barometer and the records of the new thermometers supplied to the new Civil Dispensary observatory were used for the ordinary observations and weather telegrams. Barometer No. 954, Casella, on the Kew principle was finally removed from the Telegraph Office to a room in the Civil Dispensary on 1st of June. On the 6th of January I inspected both observatories and noted as follows :—Civil Dispensary observatory, Barometer No. 954, Casella, on the Kew principle was well placed, in a good light, clean and in perfect order. Barometer No. $\frac{57}{1878}$ suspended by its side had leaked so considerably that there was not sufficient mercury in the cistern to render it safe for travelling. A small quantity of mercury was put in, but it leaked again. The position of the new thermometer shed situated on a knoll, open all round, is a great improvement upon the site occupied by the old one in the Telegraph Office compound. The roof of the thermometer shed was rather thin, and there were no side screens to protect the instruments from the rising and setting sun and rain. The cage and thermometers were clean, well kept, and in good order. The anemometer and wind-vane had just been dismounted from their old positions. The former instrument was in a dirty state, dry and stiff for want of oil, the wheels worn, and in need of proper cleaning and oiling. It was taken to pieces, thoroughly cleaned and oiled, and set in good working order. The staging for the wind velocity and direction instruments consists of a few telegraph posts fastened together, with a ladder attached. The solar radiation thermometer and rain-gauge were exposed in a railed off enclosure of about seven feet square. The Telegraph Office thermometer shed was of the Calcutta pattern, but in a very dilapidated condition. The cage and thermometers were all clean and in order. The observer at the Civil Dispensary is the civil surgeon's clerk. He read the instruments correctly, and seemed interested in his work. The observations have been carefully made, and the general condition of the observatory was satisfactory.

"NEGAPATAM.—This observatory was inspected by Mr. Eliot on the 24th of February 1888. The following is his report :—'The observatory is unchanged in position and condition of exposure since my last visit. The shed was clean and in good condition. The barometer and thermometers were all clean and in a satisfactory state. The wind-vane and anemometer were clean, and in good order.'

"RAJAHMUNDRY.—This observatory was not inspected during the year, but judging from the returns, the observations appear to have been carefully taken.

"SALEM.—This observatory was inspected by Mr. Eliot. The following is his report on the condition of the station :—'The observatory is about four miles from the Railway station, and in the compound of the Collector's office quite close to the dak bungalow. The situation is open, and exposure satisfactory. To the north and north-west are the Shevaroy Hills, and to the south a high nameless range. The barometer has been in use since 1880. A series of comparative observations was taken of the observatory barometer with a secondary standard which showed that the index error was unchanged, and that the instrument was a very satisfactory one. The observer is apparently careful and accurate in his work.'

---

* A new barometer and cage have since been supplied.—J. E.

"SECUNDERABAD.—Inspected by Mr. Eliot who reported as follows :—'Shed is in good condition and clean. Barometer is a very small and poor instrument by Negretti and Zambra. It has been in use nearly six years. The mercury surface is fairly clean. The barometer is suspended in a capital position, with very good light, in a small room of the hospital. The observer read it correctly and quickly. The thermometers were all in good order. The wind-vane and anemometer were clean and working satisfactorily.'

"TRICHINOPOLY.—This observatory was inspected by Mr. Eliot, chiefly to arrange for the completion of second class observations next year. His report is as follows :—

'The observatory was removed from its previous position in the compound of the European Hospital near the Railway station in 1885 to a piece of ground between the Superintendent and District Engineer's offices, and quite close to the public gardens. The position is fairly open, but as usual in Indian towns, there are many trees near the shed which to some extent affect the observations. The mercury surface of the barometer was much oxidized and dirty, and hence it was not possible to make a comparison except through the observer. A new and better instrument is desirable.* The thermometers were all clean and in capital condition. The wind-vane and anemometer are erected on a high wooden staging, well above adjacent trees and buildings and are in very good order.

"WELLINGTON.—This observatory was not inspected during the year, but the work has been quite satisfactory. The barometer was removed from its former objectionable position in a little room, to a more open and suitable one on the same ground level after the 10 P.M. observations on the 15th of April."

OBSERVATORIES IN BURMA.—There are in all eleven observatories in Burma, of which Akyab is under the administration of the Meteorological Reporter to the Government of Bengal, and Diamond Island, Mandalay, Bhamo and Kindat under the Central Office. The remainder are under the Sanitary Commissioner for Burma, but send their registers to the Imperial Office. Rangoon, Toungoo, Thayetmyo, Bassein and Moulmein were inspected by the Sanitary Commissioner and found to be generally in good working order. The Rangoon Observatory continued to work very unsatisfactorily during the early part of the year, and the observations showed such large and numerous discrepancies as to indicate great carelessness on the part of the observer. It was hence decided to reduce it to a third class observatory, and to place it under different conditions. I visited Rangoon in December, and with the ready assistance of Mr. Gilbert, Rector of the Rangoon College, was enabled to place it on a satisfactory footing. Dr. Romanis, Science Professor, kindly undertook to act as Superintendent, and one of the masters of the Rangoon College was selected as observer. The observations have been, since the change, very satisfactory.

I also inspected Mergui, Thayetmyo and Toungoo. The observatory at Mergui was in very good order and the observer efficient. The index error of the barometer was found to be practically unaltered. That at Toungoo was in a satisfactory condition, and the instruments, with the exception of the wet bulb, clean and in good order. A careful comparison of the barometer with a secondary standard (by means of 10 readings taken in two days) showed that the index error has altered considerably since its issue from Calcutta in April 1882. The observatory at Thayetmyo was in fair condition. The observer was absent on leave and his substitute was neither accurate nor careful in his work. Two of the thermometers, the dry minimum and grass radiation thermometers, were not in good order, as portions of the column were detached. The barometer was in good order, and ts index error relative to the Calcutta standard found to be practically unchanged. Moulmein was inspected by the head clerk of the Bengal Office in March 1888. The barometer was out of order as some air had found its way into the vacuum. Another instrument was shortly afterwards supplied. The wind-vane had not been oiled since its erection, and failed to move except under violent winds. The other instruments were in fair order. The barometric and wind observations at this station hence have been erroneous for some time. The observer's attention was called to the discrepancies in the observations for some months prior to the inspection, but he was unable to give any explanation. He was, it may be added, the recipient of a special allowance.

---

* [This has since been sent.—J. E.]

OBSERVATORIES AT THE BAY ISLANDS.—The three observatories in the Bay Islands, enumerated in page 30, require inspection, but I was unable to arrange for it during the cold weather. No special report has been received on their working and condition. The observations taken at Nancowry, that were submitted to the office during the year, contained many discrepancies such as can only be explained by inaccurate readings of the instruments or careless preparation of the returns. The returns from Port Blair also contained occasional readings which it was difficult to reconcile with the coast observations. A satisfactory explanation of these doubtful readings has not yet been received. This is much to be regretted, as the observations at these two island stations are of very considerable importance at present, and will become of very great value in connection with the storm signal service, should they ever become connected telegraphically with India.

EXTRA INDIAN OBSERVATORIES.—There are now seven of these, one having been lately established at Baghdad in Turkish Arabia. With the exception of Amini Divi, which is controlled by the Meteorological Reporter to the Government of Madras, the others send their registers direct to the Imperial Office. Aden has improved very greatly, and the observations have been sent in throughout the year with due regularity. The Leh Observatory, under the superintendence of the Revd. F. A. Redslob of the Moravian Mission, has sent in valuable and reliable observations during the past year.

The observatories at Bushire and Katmandu have worked fairly well.

The observatory at Quetta has continued to send in accurate observations.

The Amini Divi observatory has submitted a satisfactory and fairly trustworthy set of observations for the past year, and is now a useful and valuable station. Miss Pogson reports on that observatory as follows:—

> "AMINI DIVI (LACCADIVES).—The hospital assistant in charge of this observatory left the island to obtain provisions, and on attempting to return, his boat was driven ashore at Cochin, and as all communication between the island was cut off, he had to remain there until it was restored some months later. During his absence, however, the work appears to have been carried on satisfactorily by the hospital compounder who had been instructed to read the instruments by Mr. D'Cruze. On reaching the island, the permanent observer reported that all the instruments were in perfect order, with the exception of the surface of the mercury in the cistern of the barometer which had become oxidized."

INSTRUMENTS.

In Appendix A is given a return of the instruments in store at the beginning and end of the year, and of those received and issued by the India Meteorological Office during the year, and includes the stock, receipts and issues of the Alipore Observatory.

METEOROLOGICAL OFFICERS AND OFFICE WORK.

The general administration of the Meteorological Observatories and Offices in the different Provinces, with the local exceptions noticed in the foregoing sections, has been in the hands of the following officers during the year :—

Names.	Office.	Province.
H. F. Blanford, Esq., F.R.S. J. Eliot, M.A., F.R. Met. S. (Offg.)	Meteorological Reporter to the Government of India.	Central Office.
W. L. Dallas, Esq.	Assistant Meteorological Reporter to the Government of India.	
Babu Hem Raj	On probation as Personal Assistant to the Meteorological Reporter to the Government of India.	
J. Eliot, M.A. A. Pedler, Esq. F.C.S. (Offg.)	Meteorological Reporter to the Government of Bengal.	Bengal and Assam.
S. A. Hill, Esq., B.Sc.	Meteorological Reporter to the Government of North-Western Provinces and Oudh.	North-Western Provinces, Oudh, Rajputana and Central India (part).
W. L. Dallas, Esq.	Meteorological Reporter to the Government of Punjab.	Punjab.
F. Chambers, Esq.	Meteorological Reporter for Western India	Bombay, Berar, Rajputana and Central India (part).
Miss Isis Pogson, F.R. Met. S.	Meteorological Reporter to the Government of Madras.	Madras, Mysore, Coorg, and Hyderabad.
Dr. J. H. Loch	Sanitary Commissioner, Central Provinces	Central Provinces.
Dr. C. Little	Sanitary Commissioner, Berar	Berar.
Dr. D. Sinclair	Do. do. Burma	Burma.
Surgeon-Major A. E. Dalgairns. Surgeon-Major G. P. Mackenzie (Offg.)	Senior Medical Officers, Bay Settlements	Andamans and Nicobars.

Mr. Blanford went on furlough on the 1st of May, and I acted for him during the remainder of the year.

Mr. A. Pedler officiated as Meteorological Reporter to the Government of Bengal during the same period.

Babu Hem Raj was selected by Mr. Blanford as successor to Lalla Ruchi Ram Sahni, but he was at first appointed temporarily and on probation, and his permanent retention was made contingent on his passing a departmental examination, the subjects of which were fixed by Mr. Blanford.

The following table shows the number of stations, the registers of which were sent to each of the Reporters respectively, for reduction and verification during the year under report:—

PROVINCE.	METEOROLOGICAL REPORTERS.						TOTAL.
	India.	Bengal.	North-Western Provinces and Oudh.	Punjab.	Western India.	Madras.	
Bengal and Assam	4	20	...	...	...	...	24
North-Western Provinces and Oudh .	1	...	14	...	...	...	15
Punjab	2	...	...	11	...	...	13
Rajputana and Central India . .	1	...	4	...	4	...	9
Central Provinces	11	...	...	...	...	...	11
Berar	1	...	...	...	4	...	5
Bombay	...	...	...	...	13	...	13
Madras, Mysore and Coorg . .	1	2	...	...	1	16	20
Burma	10	1	...	...	...	...	11
Bay Islands	3	...	...	...	...	...	3
Extra Indian	6	...	...	...	...	1	7
	40	23	18	11	22	17	131

The list does not include the registers of the 28 provincial observatories in Bengal which are prepared and utilized in the Bengal Meteorological Office, nor those of the Colaba, Madras and Jeypore Observatories, which are furnished to the Meteorological Office with all the necessary reductions.

In Bengal, the North-Western Provinces and Madras, the Reporters collect the rainfall registers of the district and sub-divisional stations of their respective provinces. The Bengal Reporter publishes weekly and monthly rainfall returns of the Province, the North-Western Provinces weekly returns, and the Madras Reporter monthly returns in the respective provincial gazettes.

The number of rainfall stations sending returns to each of the above officers is as follow:—

	Stations.
Bengal	250
North-Western Provinces and Oudh	275
Madras	315

Mr. Hill makes the following remarks on rainfall registration in the North-Western Provinces during the past year 1887-88:—

> "The registration of rainfall in the North-Western Provinces and Oudh was continued on the same lines as in the previous year. Including the records of all the Revenue stations and the Meteorological observatories, as well as voluntary observations by Mr. G. J. Bellairs, of the Chowkuri Tea Plantation in Kumaun, observations at the Pilgrim Hospitals in Garhwal, and a selection from those made at canal stations, regular registers of rainfall at 275 stations in the province are maintained. At the majority of the stations the old float gauge is still used, but gauges of this kind are gradually

being replaced by Symons' five-inch gauge with measure glass. In addition to the stations mentioned in last year's report, the following have been supplied during the year with the new gauges:—

Muhammadabad in Farukhabad district.
Fatehpur Sikri in Agra district.
Deoriain Gorakhpur district.
Champáwat in Kumaun district.
Pithoragarh in Kumaun district.
Nanpara in Bahraich district.
Kaisarganj in Bahraich district.

Altogether, including the observatories, there are now about 160 stations with the improved gauges. It seems hopeless, however, for the present, to look for much improvement in the character of the returns, even where good gauges are used. Those revenue stations where a check is afforded by the presence of a meteorological observatory show only a little more favourably than they did last year, as may be seen from the following table:—

STATION.	TOTAL RAINFALL OF 1887.		NUMBER OF DAYS ON WHICH RAIN WAS MEASURED.	
	Observatory.	Táhsil.	Observatory.	Táhsil.
	Inches.	Inches.		
Dehra	83·07	79·44	96	79
Roorkee	46·74	42·00	71	32
Meerut	27·24	27·52	51	46
Bareilly	41·70	36·70	62	46
Agra	43·04	39·88	54	45
Allahabad	36·98	40·56	78	49
Benares	33·56	37·12	72	50
Gorakhpur	38·36	41·40	65	53
Gházipur	36·13	33·33	67	53
Jhánsi	52·55	51·29	72	48
Pithoragarh	48·68	41·80	123	87
Ránikhet	40·63	40·16*	101	79*
Lucknow	35·24	34·50	67	55

* At the treasury.

"The excess of the total rainfall at the observatories was by no means so general as in 1886; but at every observatory numerous slight, though measurable, falls of rain were noted which were neglected at the neighbouring tahsil, and the Roorkee tahsil, which is probably not the worst in the Province, had again the distinction of noting less than half the total number of rainy days."

The Reporters for Bengal and Western India administer a system of storm warnings for the protection of the local ports. The changes and extensions that have been either introduced or sanctioned during the past year are described fully in pages 10 to 17.

The meteorological observations copied from the log-books of ships entering the port of Calcutta which continue to be received, are tabulated in the Central Office, Calcutta.

Mr. Dallas has assisted me during the year in preparing the daily weather report and chart, and also discharged the duties of the Meteorological Reporter for the Punjab. He finished during the year the reduction and preparation for publication of the marine observations relating to the Arabian Sea, received in 1877 and 1880 from the London Meteorological Office, and a volume containing charts, barometric, wind and current data of the Arabian Sea, with a descriptive text, was printed and issued during the year.

OFFICE ESTABLISHMENTS.—The following is a return of the number of ministerial officers and menial servants in the offices of the several Meteorological Reporters :—

	INDIA.		Bengal.	North-Western Provinces.	Punjab.	Western India.	Madras.	TOTAL.
	Calcutta.	Simla.						
Head Clerks . . .	1	...	1	1	1	1	1	6
Computers . . .	3	...	...	...	...	...	...	3
Clerks and copyists . .	5	...	2	1	3	...	4	15
Tabulators . . .	14*	6	10	4	...	8	...	42
Draughtsmen . . .	2†	1	1	...	...	...	...	4
Artisans	...	...	3	...	...	...	...	3
Peons and menials . .	7	5	5	2	2	2	2	25

* Besides these, there were four temporary clerks during the first two months for reducing the London Meteorological Office marine logs.

† Besides these, there was one temporary draughtsman for drawing up the marine charts.

Babu Fanindra Mohun Basu has continued in charge of the Central Office in Calcutta, and maintained it in a high state of efficiency during the past year.

The Local Reporters state that their respective offices have worked satisfactorily.

WEATHER BULLETINS AND STORM-SIGNAL SERVICE.—Since the 8th April 1885, the daily weather reports issued under the authority of the Department of Revenue and Agriculture have been drawn up at Simla, a permanent establishment being retained there for the purpose. The changes made in the form of the report during the previous year have been described in pages 9 and 10, and it is unnecessary to repeat them. The substance of the verbal summary, which accompanies each issue, is telegraphed to all the Provincial Governments, and copies are furnished to the daily newspapers at Calcutta, Allahabad and Bombay.

An average of two hundred and ninety-five copies of the daily report were printed daily at the commencement of the year, and two hundred and fifty-nine at the end of the year. The reduction in the number published was effected by discontinuing them to the great majority of the district officers in Bengal, who receive the provincial report and therefore do not require the India daily report. It was issued daily to a large number of Government officers and to a few European Meteorological Societies and distinguished meteorologists, with the approval and sanction of the Government of India.

As a part of the work connected with the daily reports, notice is sent by urgent telegram to the Meteorological Office, Bombay, of the progress of any storms that advance from the Bay of Bengal towards the Western Presidency. Notice is also sent by urgent telegram to the Civil and Political Officers of Khandesh and Guzerat of the appearance of storms likely to produce floods in the Tapti and Nerbudda. Arrangements are also in force for telegraphing direct to the same officers from certain observatories, *viz.*, Jubbulpore, Hoshungabad and Khandwa (in the upper drainage basins of these rivers), the occurrence of heavy rain, in order to give them due warning of probable floods.

The Bay of Bengal reports of the storm-signal service were published every day without any break during the year by the Bengal Meteorological Office. The Lithographic

Branch of the Survey Department supplied the printed skeleton maps as in previous years. Four stations on the Burma coast, *viz.*, Rangoon, Moulmein, Bassein and Tavoy, have been added to the reporting stations. Pooree has also been recently included, and three more stations on the Madras coast are shortly to be added, when the report will become very fairly complete. The total number of stations in connection with the Bengal storm-signal service that report the observations daily by means of telegrams is now 25, and with the addition of Bimlipatam, Nellore and Cuddalore on the Madras coast it will shortly be 28 in all. The daily weather report observations were in 1887-88 and in previous years taken at 10 A.M., but, as stated previously, the hour of observation has been changed experimentally to 8 A.M. from 1st April 1888. The telegrams were received very regularly from almost all the stations. This report was supplied during the year to 33 Government officers and 22 subscribers paying at the rate of R2 a month. The receipts from the subscribers during the year have covered the cost of lithographing the reports in the Bengal office and distributing them. There was a balance of R115-10-6 at the end of 1887-88.

During the year the Bengal provincial daily weather reports were published during the period 30th April to 7th November. Forty-one stations sent in daily observations by means of telegrams against 38 of the preceding year. This increase is due to the addition of the stations of Sibsagar, Dhubri and Silchar to the list.

The Bay of Bengal was singularly free from large cyclonic storms during the year, more especially in the months of October, November and December. The following extract from Mr. Pedler's report describes the storm-warning work done by the Bengal Reporter during the year:—

"STORM SIGNALS.—During the year the procedure with reference to hoisting storm signals in Bengal was revised under Government of Bengal Notification, dated 4th August 1887, published in the *Calcutta Gazette* of the 10th August 1887. Under this notification the Bengal Meteorological Reporter is now charged with the duty of actually ordering the hoisting of all the storm signals, not only at Calcutta and the approaches to it, but also at Chittagong and the various Orissa ports, and without orders from the Bengal Reporter no signal at these ports can be hoisted.

"By the same notification also, a slight alteration was made in the meaning of one of the storm signals, which had been for some years in use in the river approaches to Calcutta. By this notification there is now one signal which can be hoisted when the indications which are given of the formation and line of advance of a storm are not well defined. This signal is called a bad weather preparatory signal, and it merely means that a cyclonic storm of undetermined intensity and magnitude has formed in the Bay of Bengal, which is too far off to enable its line of advance to be ascertained with certainty. This will probably be a very useful addition to the Code of Signals.

"A further and more important change which was also made in this notification was to extend the use of the full code of storm signals, which had hitherto only been employed in the river approaches, to the port of Calcutta as well. Hitherto information as to the nature and size of storms in the Bay has in some cases only been able to be conveyed to ships while they were actually passing down the river, or, in other words, while actually proceeding towards the danger. By the change which has now been brought about after sundry efforts of the Meteorological Department, full information will be able to be communicated to ships of storms in the Bay before they leave the port, and their safe anchorage.

"HOISTING OF STORM SIGNALS.—During the year it was only necessary to hoist the storm signals in the river Hooghly on two occasions, *viz.*, first during the Balasore cyclone of May 20th to 26th, 1887, when the signals were ordered to be hoisted at the signal stations of Diamond Harbour, Mud Point and Saugor Island from 8 o'clock on the morning of the 25th May to 7 A.M. of the 27th May, and the second time during the storm in June from 1 P.M. of 12th to 1-25 P.M. of the 14th.

"BALASORE CYCLONE, MAY 20TH TO 28TH, 1887.—The formation of the Balasore cyclone on the 20th May was notified in the Bay of Bengal Daily Weather Report, and its development and advance towards the land were dealt with in the succeeding days' reports until it reached the Balasore coast on the morning of May 26th. During the formation and advance of the storm towards the land, warnings of its existence and line of march were issued widely to the ports round the Bay of Bengal, and to the various officers appointed to receive such warnings. Full and detailed reports of the action taken by this office during this storm have already been submitted during the year, and it is therefore not necessary to repeat them here. A full and detailed description of the Balasore storm has been published by Mr. Eliot, as Part I of the Cyclone Memoirs.

"CYCLONIC STORM OF JUNE 10TH TO 14TH, 1887.—The second cyclonic storm, which was also of very considerable intensity at sea, formed in the northern half of the Bay from the 8th to the 10th of June. It gradually increased in intensity and slowly travelled in a westerly direction, crossing the coast about midway between Gopalpur and Vizagapatam on the 13th. The lowest pressure recorded was 29·3 inches at Gopalpur on the night of the 13th. Reports from ships involved in the storm shewed that very strong winds with a high sea and very bad weather, accompanied the storm in the Bay.

"A considerable number of smaller and more feeble barometric depressions occurred during the prevalence of the south-west monsoon over the Bay. These are detailed in the monthly summaries issued from this office. The principal smaller storms in 1887 were—

"STORM OF JUNE 19TH TO 22ND.—It formed as a shallow depression to the south-east of Saugor Island on the 19th, giving general heavy rainfall to South-West Bengal and Orissa. It passed inland in a north-westerly direction, and on the 20th the centre was between Burdwan, Bankoora and Raneegunge, where the cyclonic circulation of winds was most distinct, and on the 21st it had reached South Behar. This storm gave very heavy rainfall in its advance.

"In July there were 4 feeble storms—

The 1st from July 2nd to 8th;
The 2nd from July 9th to 13th;
The 3rd from July 11th to 17th;
And the 4th from July 19th to 28th.

These four depressions all affected the central, western and south-western districts of Bengal only, and by the rainfall they brought up, they caused the rainfall in July of these districts to be heavier than it otherwise would have been, and thus many parts of these districts received falls in excess of the normal, while considerable tracts of the north and east of the Province received very deficient rainfall. The first three storms were of little importance. The fourth small storm however was rather a noticeable one. It formed to the east or south-east of False Point on the 19th, and it remained almost stationary, moving only slightly from day to day in the north-west angle of the Bay until the 24th. On the morning of the 25th it had moved slowly inland, and then travelled through the south of Chutia Nagpur to Jubbulpore and Sutna, where it disappeared.

"In August two depressions were formed. The first existed from the 14th to 20th August 1887. It was a remarkably persistent storm, though the barometric depression at its centre was feeble. It was formed in the centre of the Bay, and crossed the South Orissa coast a little to the south of Gopalpur on the 19th, and drifted into the Central Provinces. The sea was rough, and weather squally in the Bay during this storm.

"The second small storm was formed in South-East Bengal on the 26th and 27th, and moved in a westerly direction through South-West Bengal to Chutia Nagpur, where it dispersed.

"In September there were three small storms.

"The first depression lasted from September 9th to 12th, and crossed the coast between Saugor Island and False Point.

"The second existed was a very brief storm, and lasted from the morning of the 15th to the evening of the 16th. It crossed the coast near Balasore.

"The third storm lasted from the 22nd to the 26th. It was formed close to the Sunderbuns to the south or south-west of Burrisal, and gave for a day or two very heavy weather at the head of the Bay. It afterwards advanced inland in a northerly or north-north-easterly direction, and broke up finally in North Bengal on the 26th.

"In October there were two cyclonic storms formed in the Bay.

"The first lasted from October 8th to 11th. It formed to the west of the centre of the Bay, and crossed the coast of Madras between that station and Masulipatam, and afterwards almost crossed the Peninsula moving in a north-westerly direction. It was not a violent storm, but it gave a gale of wind at Madras, and as far north as Cocanada and Vizagapatam, and also heavy rain along the coast. This storm was however, exceptionally important to Bengal, for at the period when the storm was formed, the monsoon rainfall had practically ceased in the province, and some parts of the country had received such deficient falls that the crops were withering up. The effect of the storm in the Bay was to cause a late advance of humid winds up the Bay, and a wave of rainfall passed over the province lasting from about the 10th to the 15th, and though the rainfall was not very heavy, it did an immense amount of good.

"The second storm existed from October 27th to 31st. It began to be formed in the south-east of the Bay with squally weather and strong winds on the 27th. It drifted in a westerly direction, and was opposite the coast between Madras and Negapatam on the 29th. On the 30th it was opposite Madras, and on the 31st to the north-east of that station, and as it approached the land it filled up, causing general disturbance over the Bay which lasted till early in November.

"Another small barometric depression was formed in the centre and south of the Bay in the middle of November, and drifted to the Madras coast on the 18th. From this date no further storms were formed in the Bay till the end of the year. The retreat of the south-west monsoon down the Bay in 1887 was therefore unusually quiet, though the commencement of the monsoon had been marked by one of the fiercest storms on record, *viz.*, the Balasore cyclone of May."

Mr. Chambers describes his storm-signal work during the year as follows:—

"*Storm-Warning Service.*—This service has been carried on as in previous years. Daily telegrams are received from nine stations on the West Coast of India, and from three on the Coromandel Coast.

"The following table shows the dates on which warnings were issued, and the nature of the warnings:—

Names of Ports.	Dates on which telegraphic orders to hoist the storm signals were issued.	Dates on which cautionary telegrams were issued.
Karachi	. . . .	9th June, 15th July, 16th July, 18th July and 4th January.
Bhavnagar	15th July	9th June and 4th January.
Daman	15th July and 4th January	9th June.
Bombay	4th January	15th July.
Alibag	4th January	8th June, 9th and 10th October.
Ratnagiri	11th October and 4th January	8th June, 9th and 10th October.
Vingorla	11th October	8th June, 9th and 10th October.
Goa	11th October	8th June, 9th and 10th October.
Mormagao	. . . .	9th, 10th and 12th October.
Karwar	11th October	8th June, 9th and 10th October.
Kumta	11th October	8th June, 9th and 10th October.

"On the 5th of June the regular Daily Telegraphic Weather Reports gave some indications of the formation of a slight barometric depression off the coast of the Konkan. Special reports were called for from inland stations, and on the arrival of these reports on the 6th, it was found that on that day the depression had deepened somewhat and moved northwards. The gradients were, however, nowhere steep, and the winds were nowhere strong, and therefore no storm warnings were issued. On the 7th the depression was still deeper and the winds had now become decidedly cyclonic, but as they were not strong, no warnings were issued. On the 8th the depression at land stations was about the same as on the previous day, but the winds had strengthened considerably, and cautionary telegrams announcing the existence of the disturbance were sent to all the coast ports between Bombay and Kumta. On the 9th the barometer rose everywhere, the winds became weaker, and the depression moved northwards. Cautionary telegrams were then sent to Karachi, Daman and Bhavnagar. On the 10th a further rise of pressure took place, but the wind continued to blow strongly at Bombay. On the 11th the disturbance had disappeared. Subsequent investigation has shown that this disturbance was caused by the formation off the coast of Bombay of a severe cyclone which moved westward, and in which both the outgoing and incoming English mail steamers as well as many other vessels were involved. There is little doubt that one large vessel, the *Lamport*, foundered in this cyclone, and many others were much damaged.

"About noon on the 15th July, a telegram was received from Simla announcing the existence on the 14th of a slight barometric depression near Raipur, moving westward. Telegrams from the northern inland stations were at once called for, and at 8-15 P.M., the following telegram was sent to the Port Officers of Karachi and Bombay :—'There is a cyclonic depression of the barometer at Indore. It is moving in a west-north-west direction. It will probably cause rough weather in Guzerat.' The same telegram was sent to Bhavnagar and Daman, with orders to hoist the storm signals. At 8-25 P.M., the following telegram was sent to the Collectors of Surat, Broach and Ahmedabad, and to the Agent of the Bombay, Baroda and Central India Railway :—'A cyclone is passing in a west-north-west direction across the Narbada Valley into Guzerat. It may cause floods in one or more of the Guzerat rivers.' On the 16th the centre of the depression was near Bhuj, and had partly filled up. On the 17th it had passed out of the field of observation to the westward to Karachi.

"On the 9th October the regular daily telegrams shewed that a small cyclone had crossed the Coromandel Coast near Madras. Special telegraphic reports were immediately called for from inland stations in the Peninsula, and at 9-30 P.M. its character had been sufficiently well determined to make it possible to issue the following cautionary telegram to all the ports between Bombay and Kumta :—'A small cyclone crossed the Coromandel Coast near Madras this morning, moving west-northwestward.' On the 10th the centre of the depression had moved to near Dharwar, and the Port Officers were informed of the fact. On the 11th the centre was between Belgaum and Goa, and the depression had deepened somewhat. Orders were then issued to hoist the storm signals at all the ports from Ratnagiri to Kumta. On the 12th the depression extended northward along the Ghâts, and on the 13th it had partially filled up and passed inland in a north-easterly direction between Poona and Sholapur.

"On the 3rd January 1888 the regular daily telegrams indicated the existence of a very slight depression on the Bombay Coast, the centre of which was probably between Karwar and Goa, and a note to that effect was made in the daily report to the Port Officer, Bombay. On the 4th, before the arrival of the telegraphic reports, a moderate gale sprang up at Bombay from north-east. As soon as the telegram from Ratnagiri arrived, the gale was seen to be of cyclonic character, and shortly before noon the following telegram was sent to the Port Officers at Bombay, Alibag and Ratnagiri :—'Centre of small cyclone now off coast between Ratnagiri and Bombay. Hoist storm signal.' A few minutes later a similar telegram was sent to Daman, and cautionary telegrams were issued to Bhavnagar and Karachi. This small cyclone appears to have passed inland in a north-easterly direction after crossing the coast between Bombay and Surat. It caused excessive and very unusual rain in the basin of the Tapti, and rapidly broke up. On this occasion the storm signals were hoisted too late to be of much use, although they were hoisted as soon as the disturbance was known to be of a cyclonic character, and without waiting for any information from the inland stations. Indeed, before any special information could be obtained from inland stations, the storm had disappeared."

WEEKLY, MONTHLY AND SEMI-ANNUAL REPORTS.—A descriptive summary of the weather was prepared monthly during the year and published in the *Gazette of India*. A report on the winter and spring snowfall was also drawn up in June, and a forecast of the character of the rains was attempted, which has been noticed in Part I of this report. Weekly meteorological reports have also been published throughout the year in the *Gazette of India*, giving a short *resumé* of the weather of the week, drawn up partly from the daily reports for the period, and partly from additional rainfall information obtained by telegram from a large number of stations.

Charts of the rainfall for the three seasons into which the year has been divided for this purpose (*viz.*, the cold season, the hot season and the rains) have been prepared for

1887 from the rainfall registers received by post, and several copies furnished to Government, but these are not published. A general chart and tabular return of the rainfall of the year 1887 was also prepared for the Secretary of State.

In Bengal, weekly and monthly meteorological and rainfall reports for the province are published in the *Calcutta Gazette*, and sets of three rainfall charts, showing the actual distribution of the rainfall and its variation from the average, *first*, in absolute measurement, and *second* as a percentage of the normal average, are prepared monthly for the Government of Bengal. A general summary of the weather of the south-west monsoon and the distribution of the accompanying rainfall in Bengal was also drawn up for the Local Government.

In the North-Western Provinces and Bombay, monthly abstracts of the registers of the several observatories, and, in the former, weekly rainfall reports, are published in the local *Gazettes;* and in the Punjab, since the beginning of 1886, a descriptive summary of the weather of the province, together with a chart showing the distribution of the rainfall of the month, and the mean winds and pressure at the twelve observing stations in the Punjab, has been prepared monthly for Government and published in like manner.

ANNUAL REPORT.—The report on the meteorology of the year 1886 was complete and in the printer's hands in August 1887, and the printed report submitted to Government on the 31st January 1888.

The report gives tables of temperature for 137 stations, and rainfall returns for 500 stations, being an increase of four in each case on the numbers respectively given in the report for 1886. The returns of the other meteorological elements are nearly as numerous as those of temperature. The elements tabulated in the Appendix are given in the following table. For comparison, the corresponding numbers for the four previous years are given:—

	NUMBER OF STATIONS.				
	1882.	1883.	1884.	1885.	1886.
Equilibrium temperatures of solar radiation	112	111	113	104	109
Duration of bright sunshine	...	2	3	4	6
Temperatures of nocturnal radiation	104	107	106	108	108
Temperatures of the ground	4	4	4	5	5
Mean and extreme air temperatures	130	134	138	133	137
Sea-level equivalents of mean temperatures	108	111	112	111	113
Means and extremes of atmospheric pressure	124	125	127	128	132
Sea-level equivalents of mean atmospheric pressure	108	109	110	110	111
Direction and movement of winds	125	127	128	128	132
Temperature of evaporation	120	124	128	131	127
Tension of atmospheric vapour	127	130	135	130	134
Mean relative humidity	127	130	135	130	134
Mean proportion of clouded sky	124	127	130	131	135
Inches of rainfall in each month	457	462	478	486	500
Number of days on which rainfall was measured	457	462	474	482	500

The descriptive letter-press discusses the chief characteristics of the meteorology of the year. It includes tables of the average values of all the more important meteorological elements for all stations that have furnished returns for three years and upwards, and the report is illustrated with five plates, *viz.*, a chart showing the position of all observatories and rain-gauge stations, three in coloured lithography representing the mean distribution of temperature, pressure and winds in each month of the year, and one showing the tracks of the storms which originated in the Bay of Bengal during the year.

The original observations of seven observatories, *viz.*, Calcutta, Lucknow, Allahabad, Lahore, Nagpur, Bombay and Madras, were issued as a distinct publication in monthly parts. Those forming the volume for 1887 were completed in April 1888.

The Reporters for Bengal, the North-Western Provinces, the Punjab and Western India each prepared and submitted to the local Governments summaries of the weather features of the year in their respective provinces.

Appendix B gives a list of the Government Officials, Libraries, Observatories, Societies, &c., to which the publications of the office are presented, including those which send their own publications in exchange.

LIBRARY.

The additions to the library during the past year are enumerated in Appendix C. The library remains, as last year, in ten double book-cases in a large room on the ground floor of the office building. It is in good order, but it has not been practicable to undertake its re-arrangement, no officer having been available for the purpose.

JOHN ELIOT,
Offg. Meteorological Reporter to the Government of India.

CALCUTTA:
The 17th July 1888.

APPENDIX A.

Return of the Stock, Receipt and Issue of Instruments for the year 1887-88.

Instruments.	In store on 1st April 1887.	Received, 1887-88.	Issued, 1887-88.	In store on 31st March 1888.
Barometer Observatory, Fortin's principle	12	16	19	9
Do. do. Kew do.	8	9	9	8
Do. Mountain, portable Tripod (Adie)	14	4	5	13
Do. Marine, Kew principle	20	5	5	20
Do. Newman's large standard	1	...	1	...
Do. Negretti and Zambra (various)	8	1	2	7
Do. Aneroids	16	2	3	15
Hick's Barograph	1	...	...	1
Thermometers, standard with attached scales	11	18	1	28
Do. do. without attached scales	...	6	...	6
Do. for Hygrometers (Kew pattern)	65	45	33	77
Do. Maximum for shade	47	38	11	74
Do. Solar in vacuo (self-registering)	17	28	7	38
Do. do. do. (non-self-registering)	26	1	1	26
Do. do. not in vacuo	2	...	...	2
Do. Minimum for shade	27	41	25	43
Do. do. for radiation	32	13	23	22
Sling thermometers	14	1	2	13
Chemical thermometers	6	1	...	7
Six's thermometers	7	...	...	7
Traveller's maximum and minimum thermometers, in pairs	6	...	1	5
Frankland's sun thermometers	3	...	...	3
Boiling point thermometers	7	...	...	7
Thermograph with Negretti and Zambra's sets of recording thermometer	1	...	...	1
Ponilet's Pyrhilliometer	1	...	...	1
Stewart's Actinometers (thermometers for)	7	...	...	7
Do. do. (chambers for)	1	...	...	1
Hodgkinson's Actinometers	2	...	...	2
Harschell's do.	1	...	...	1
Regnault's Hygrometers	3	...	...	3
Daniel's do.	10	...	...	10
Halleur's do.	5	...	...	5

Return of the Stock, Receipt and Issue of Instruments for the year 1887-88—continued.

Instruments.	In store on 1st April 1887.	Received, 1887-88.	Issued, 1887-88.	In store on 31st March 1888.
Pocket spectroscopes (Browning's)	1	...	...	1
Anemometers	25	46	28	43
Wind vanes	16	2	13	5
Beckley's anemograph	3	1	2	2
Casella's do.	2	1	...	3
Draper's self-recording Sun thermometers	1	...	1	...
Electrical anemometer and wind vanes	3	...	...	3
Rain-gauges (Symons') 5″ diameter	35	110	21	124
Do. do. 6″ do.	1	1	...	2
Do. do. 8″ do.	1	3	1	3
Measure glasses for 5″ Rain-gauge	44	148	9	183
Do. for 6″ do.	1	10	1	10
Do. for 8″ do.	3	1	1	3
Reading lenses	1	4	3	2
Sun thermometer stands	10	...	3	7
Radiation pads	8	...	3	5
Barometer cages	...	1	1	...
Thermometer cages	6	...	2	4
Do. do. for ships	12	2	...	14
Prismatic compasses	1	...	...	1
Sand-glasses (3 minutes)	10	30	11	29
Sun-dials	1	...	...	1
Clocks	...	4	4	...
Bottles for wet bulb thermometers	112	...	8	104
Electrophorous	1	...	...	1
Filled tubes for Marine K. P. barometers	8	10	6	12
Do. for Observatory K. P. barometers	17	10	...	27
Chain for Casella s embossing anemograph	100 ft.	...	...	100 ft.
Gauges for testing Symons' rain-gauges	1 pair	...	...	1 pr.
Plummet brass	...	1	...	1
Bull's eye lanterns	...	1	1	...

APPENDIX B.

List of Recipients of the Publications of the Meteorological Office.

Adelaide	Meteorological Observatory.
Agra	Editor of the *Delhi Gazette*.
Ajmere	Chief Commissioner.
Algeria	Meteorological Service of the Ecole des Sciences d'Alger.
Allahabad	Secretary to the Government, North-Western Provinces and Oudh.
	Department of Revenue and Agriculture, North-Western Provinces and Oudh.
	Meteorological Reporter, North-Western Provinces and Oudh.
	Sanitary Commissioner, ditto ditto.
	Editor of the *Pioneer*.
Amraoti	Sanitary Commissioner for Berar.
Amsterdam	Royal Academy of Sciences.
Bangalore	Chief Commissioner, Mysore and Coorg.
	Inspector General of Forests, Mysore and Coorg.
Batavia	Magnetical and Meteorological Observatory.
Berlin	Royal Prussian Meteorological Institute.
Bombay	Secretary to the Government of Bombay.
	Meteorological Reporter for Western India.
	Colaba Observatory.
	Sanitary Commissioner with the Government of Bombay.
	Bombay University.
	Asiatic Society of Bombay.
	Sassoon Mechanics Institute.
	Geographical Society of Bombay.
	Editor of the *Bombay Gazette*.
	Ditto *Times of India*.
	Elphinstone College.
Brisbane, Queensland	Observatory.
Brussels	Royal Academy of Sciences.
	Royal Observatory.
Bucharest, Roumania	Meteorological Institute.
Budapesth	Observatory.
Calcutta	H. M. Secretary of State for India (through Revenue and Agricultural Dept.).
	Private Secretary to His Excellency the Viceroy.
	Secretary to the Government of India, Revenue and Agricultural Department.
	Ditto ditto, Home Department.
	Ditto ditto, Public Works Department.
	Ditto ditto, Foreign Department.
	Ditto ditto, Department of Finance and Commerce.
	Ditto ditto, Military Department.
	Secretary to the Government of Bengal, Revenue Department.
	Meteorological Reporter to the Government of Bengal.
	Surveyor-General of India.
	Geological Survey of India.
	Sanitary Commissioner with the Government of India.
	Ditto to the ditto Bengal.
	Superintendent, Botanical Gardens, Calcutta.
	Inspector-General of Forests with the Government of India.
	Surgeon-General with the Government of India.
	Asiatic Society of Bengal.
	Indian Museum.
	Calcutta University.
	Presidency College.
	Public Library.
	Editor of the *Calcutta Review*.
	Ditto *Statesman and Friend of India*.

List of Recipients of the Publications of the Meteorological Office—continued.

Calcutta—*contd.*	Editor of the *Englishman.*
	Ditto *Indian Daily News.*
	Ditto *Hindu Patriot.*
	Ditto *Indian Agriculturist.*
	Pat. Doyle, Esq., C.E., Editor, *Indian Engineering.*
	St. Xavier's College Observatory.
	The Alipore Observatory.
	Mint Master.
	Indian Association for the Cultivation of Science.
Cambridge	University Library (through H. M.'s Secretary of State for India).
Cambridge, Massachusetts	Harvard University.
Cape of Good Hope	Astronomer Royal.
Carlsruhe, Baden, Germany	Bureau für Meteorologie und Hydrographie.
Chemnitz	Royal Meteorological Institute.
Chatham	Royal Engineers' Library.
Christiania	Norske Meteorologiske Institut.
	Royal Observatory.
Colombo	Editor of the *Ceylon Times.*
	Ditto *Ceylon Observer.*
	Surveyor-General of Ceylon.
Copenhagen	Danske Meteorologiske Institut.
	Royal Danish Academy of Sciences.
Cordoba	Meteorological Office.
	National Academy of Science
	Servicio Meteorologico de la Provincia de Cordoba.
Darjeeling	Conservator of Forests, Bengal.
Dehra Dun	Editor of the *Indian Forester.*
	Superintendent, Great Trigonometrical Survey.
Dharwar	Conservator of Forests, Bombay, Southern Division.
Dublin	Royal Dublin Society.
Dacca	Dacca College.
Edinburgh	Scottish Meteorological Society.
	Astronomer Royal for Scotland, Royal Observatory.
	Scottish Geographical Society (through H. M.'s Secretary of State for India).
	Royal Observatory.
Greenwich	Astronomer Royal, Royal Observatory.
Guatemala	Observatorio Meteorologico del Institut Nacional de Guatemala.
Hamburgh	Nord Deutsche Seewarte.
	Deutsche Meteorologische Gessellschaft.
Havana	Real Collegio de Belen.
Hong-Kong	Observatory.
Indore	Agent to the Governor General for Central India.
Iowa, U. S.	Iowa Weather Service.
Jeypore	Maharajah's Observatory.
Jubbulpore	Civil Surgeon.
Katmandu	Resident at Nepal.
Khandwa	Civil Surgeon of Nimar.
Kitzingen, Bavaria	Dr. Emil Von Schlagintweit.
Kurrachee	Conservator of Forests, Bombay, Sind Division.
Lahore	Secretary to the Government of the Punjab.
	Meteorological Reporter ditto ditto.
	Sanitary Commissioner ditto ditto.
	Conservator of Forests ditto ditto.
Leeds	Yorkshire College (through H. M.'s Secretary of State for India).
Leipzig	Geographical Society.
Lisbon	Observatoire de Infante d'Luiz.
	Academy of Sciences.
London	Meteorological Council.
	Royal Society.
	Royal Asiatic Society (through H. M.'s Secretary of State for India).
	Northbrook India Club (through H. M.'s Secretary of State for India).
	Society of Arts.
	Institution of Civil Engineers.
	Royal School of Mines.

London—*contd.*	Royal Meteorological Society.
	Admiralty Library.
	United Service Institution.
	British Museum (through H. M.'s Secretary of State for India).
	Athenœum Club.
	Editor of the *Philosophical Magazine.*
	Ditto *Athenœum.*
	Ditto *Nature.*
	Ditto *Symons's Monthly Meteorological Magazine.*
	Ditto *Westminister Review.*
	Ditto *Quarterly Review.*
Madras	Secretary to the Government of Madras.
	Ditto ditto, Public Works Department.
	Meteorological Reporter to the Government of Madras.
	Government Astronomer, Madras.
	Sanitary Commissioner, Madras.
	Madras University.
	Editor of the *Madras Times.*
	Ditto *Madras Mail.*
	Ditto *Christian College Magazine.*
	Government Central Museum.
	Assistant Director of Agriculture, Government of Madras.
	Surgeon-General, British Medical Department.
	Ditto, Indian Medical Department.
	Port Officer of Madras.
	Conservator of Forests, Northern Circle.
	Ditto ditto Southern Circle.
Madrid	Royal Observatory.
Madgeburg	Observatory of the Magdeburg Zeitung.
Manchester	Literary and Philosophical Society.
Manila	Meteorological Observatory.
Mauritius	Meteorological Society.
Melbourne, Victoria	Observatory.
	University Library.
	Public Library.
Mexico	Central Meteorological Observatory.
Milan	Royal Astronomical Observatory.
Munich	Royal Observatory.
	Royal Bavarian Academy of Sciences.
	Geographical Society.
	Royal Bavarian Meteorological Central Station.
Nagpur	Chief Commissioner, Central Provinces.
	Sanitary Commissioner, ditto.
	Inspector-General of Education, Central Provinces.
	Meteorological Observatory.
	Conservator of Forests, Central Provinces.
Naini Tal	Ditto ditto Central Circle, North-Western Provinces and Oudh.
New Haven, Connecticut	Connecticut Academy of Arts and Science.
	Editors of the *American Journal of Science.*
New York, U. S.	Meteorological Observatory.
Ootacamund	Editor of the *South of India Observer.*
Oxford	Radcliffe Library.
	Radcliffe Observatory.
Paris	Observatoire Municipal de Montsouris.
	Editor of *La Nature.*
	Physical Observatory, Meudon.
	Bureau Central Météorologique de France.
	Meteorological Society of France.
Perpignan, France	Observatoire Météorologique et Magnetique.
Perth, W. Australia	Meteorological Reporter.
Pesaro, Italy	Royal Observatory.
Philadelphia	Franklin Institute.
Poona	Conservator of Forests, Northern Circle, Bombay Presidency.
Prague, Bohemia	K. K. Sternwarte.

List of Recipients of the Publications of the Meteorological Office—concluded.

Raipur	Civil Surgeon.
Rangoon	Chief Commissioner, Burma.
	Sanitary Commissioner, ditto.
	Conservator of Forests, ditto.
	Editor of the *Rangoon Times*.
Rome	Central Meteorological Office.
Rio de Janeiro	Imperial Observatory.
Saharunpore	Superintendent, Botanic Gardens.
Santiago	Observatorio Nacional.
Secunderabad	Secretary to the Resident at Hyderabad.
Shillong	Chief Commissioner of Assam.
	Conservator of Forests, Assam.
Simla	Assistant Quarter Master General, Intelligence Branch.
Singapore	Principal Civil Medical Officer, Straits Settlements.
Stockholm	Nautisk Meteorologiska Byran.
St. Petersburg	Physical Central Observatory.
	Imperial Geographical Society of Russia.
	Prof. H. Wild, Physical Central Observatory.
Strasburg	Imperial University Library.
Stonyhurst	Stonyhurst College Observatory.
Sydney	Observatory.
	University Library.
Syracuse, Sicily	Royal Meteorological Observatory.
Tasmania	Royal Society.
Tiflis, Russia	Physical Observatory.
Tokei, Japan	Imperial Mining Office.
	Imperial Meteorological Observatory.
Toronto, Canada	Meteorological Office.
Turin	Royal Astronomical Observatory.
	Meteorological Society of Italy.
Upsala	Meteorological Observatory.
Utrecht	Royal Netherlands Meteorological Institute.
Vienna	K.K. Central-Anstalt für Meteorologie und Erdmagnetismus.
	K.K. Geologische Reichsanstalt.
	Imperial Academy of Sciences.
	Dr. J. Hann.
Vizagapatam	A. V. Nursingrow, Esquire.
Washington, U. S.	Chief Signal Officer, United States Army.
	Smithsonian Institution.
	United States Naval Observatory.
	Hydrographic Office.
	Professor Cleveland Abbe.
	United States Geological Survey.
Wellington, New Zealand	Observatory.
Woolwich	Royal Artillery Library.
Zi-ka-wei, Shanghai	Magnetical and Meteorological Observatory.
Zurich	Central Meteorological Institute.

APPENDIX C.

Presentations to the Library from the 1st April 1887 to the 31st March 1888.

Place.	Donors.	Title of Work.
Algeria	Meteorological Service	Bulletin Météorologique du Gouvernemen: général de l'Algérie, 1st March 1887 to 31st January 1888.
		Bulletin Mensuel, August 1886 to March 1887.
		Observations Météorologiques du Reseau Africain, Annee 1883.
Allahabad	Government of the N.-W. Provinces and Oudh.	Gazetteer of the N.-W. Provinces, Vols. I to XIV.
		Gazetteer of the Province of Oudh, Vols. I to III.
		Supplement to the Fatehpur Gazetteer.
	Meteorological Office	Administration Report of the Meteorological Reporter to the Government of the N.-W. Provinces and Oudh for the year 1886-87.
	S. A. Hill, Esq.	Some anomalies in the winds of Northern India and their relation to the distribution of barometric pressure.
Amsterdam	Royal Academy of Sciences	Jaarboek voor 1885.
		Verslagen en Mededeelingen der Koninklijke Akademie van Wetenschappen, Afd Natuurkunde, Derde Reeks, Deel II.
Batavia	Magnetical and Meteorological Observatory.	Rainfall in the East Indian Archipelago, 1886.
		Observations made at the Magnetical and Meteorological Observatory at Batavia, Vol IX.
Berlin	German and Austrian Meteorological Society.	Meteorologische Zeitschrift, March to December 1887.
	K. Preussischen Meteorologischen Institut.	Ergebnisse der Meteorologischen Beobachtungen im Jahre 1886.
Berne	Dept. de l'interieur de la Confédération Suisse.	Tableau graphique des observations hydrométriques suisses pour le Rhin, Aar, Tessin, Rhone, Limmat, and Ruess, July 1886 to June 1887.
Blue Hill (U. S. A.)	A. Lawrence Rotch	Results of the Meteorological observations made at the Blue Hill Meteorological Observatory in the year 1886.
Bombay	Government of Bombay	Twenty-third Annual Report of the Sanitary Commissioner for the Government of Bombay for 1886.
	Government Observatory	Magnetical and Meteorological observations made at the Government Observatory, Bombay, for 1885.
	Meteorological Office	Brief sketch of the Meteorology of the Bombay Presidency in 1886-87.
Brisbane	Meteorological Observatory	Meteorological synopsis of the Brisbane Observatory for January to July 1887.
		Rainfall summaries taken at stations in the Colony of Queensland during January to June 1887.
		Correspondence relating to Meteorological Inspection and proposals for a new meteorological organization in the Colony of Queensland.
		Weather chart of Australasia at 9 A.M., 3rd September 1887 to 9th February 1888 (Sundays and holidays excepted).
Brussells	Royal Academy of Sciences	Annuaire, 1886 and 1887.
		Bulletin, 3rd series, Tomes IX to XIII.
Budapesth	Central Anstalt für Meteorologie- und Erdmagnetismus.	Jahrbucher, XV Band, Jahrgang 1885.
Calcutta	Comptroller and Auditor General	Civil Estimates 1887-88, Vols. I and II.
	Consul General of France	Compte Rendu des seances de la Commission Centrale des Société de geographie de France.
	Geological Survey of India	Memoirs, Vol. XXIV, Part I.
		Records, Vol. XX, Parts 2 to 4, and Vol. XXI, Part I.
		Manual of the Geology of India, Part IV.

Presentation to the Library from the 1st April 1887 to the 31st March 1888—continued.

Place.	Donors.	Title of Work.
CALCUTTA	Government of Bengal.	Returns of the Rail-borne Traffic of Bengal during the quarters ending the 31st December 1886, 31st March, 30th June, and 30th September 1887, and for the year 1886-87.
		Report on the external Trade of Bengal with Nepal, Thibet, Sikkim, and Bhutan for the year 1886-87.
		Report on the River-borne Traffic of the Lower Provinces of Bengal and on the Inland Trade of Calcutta and on the Trade of Chittagong and the Orissa ports, with notes on Road Traffic for 1886-87.
	Government of India, Home Department.	Report of the Meteorological Council of the Royal Society for the year ending 31st March 1886.
		Instructions for keeping Log Books and compiling Meteorological Returns issued by the Bureau of Navigation, Navy Department, United States, America.
	Government of India, Revenue and Agricultural Department.	India Office List for 1886.
		Variations of the Prices of Staple Food-grains in the Bombay Presidency by F. Chambers, Meteorological Reporter for Western India.
		Hand-book of Stations on Indian Railways corrected up to 31st December 1886.
		Report on the condition and proceedings of the Government Observatory, Colaba, for the year which ended with the 30th June 1887.
		Administration Report of the Indian Marine for 1886-87.
		List of Civil Officers holding Gazetted Appointments under the Government of India in the Home, Legislative, Foreign, and Revenue and Agricultural Departments corrected to 1st July 1887.
		Administration Report upon the Madras Observatory for the year 1886.
		Civil Travelling Allowance Code, Revised Edition, Chapters 1 to 15 only (Provisional Issue).
		Imperial Gazetteer of India, 2nd Edition, Vols. XII, XIII and XIV.
		Report of the Public Service Commission, 1886-87, with Appendices and Proceedings of the Sub-Committee.
		Proceedings of the Public Service Commission, Vols. I to VI.
	Henry F. Blanford, Esq.	Report on the preparations for, and observations of, the Transit of Venus, as seen at Roorkee and Lahore on the 8th December 1874.
	Indian Association for the Cultivation of Science.	Report of the Tenth Annual Meeting held in April 1887.
	Inspector General of Forests	Report on the Course of Instruction at the Forest School, Dehra, for the year 1886-87.
	Meteorological Office, Bengal	Report on the Administration of Bengal for 1885-86.
	Pat. Doyle, Esq.	Indian Engineering, Vol. III, Nos. 9 to 13.
	Public Library	Report of the Calcutta Public Library for 1887, with Appendices.
	S. R. Elson, Esq.	Memoranda of Useful Information for Shipmasters.
		Changes observed in the Density of the surface Sea-water at the Sandheads.
	Sanitary Commissioner with the Government of India.	Twenty-second and Twenty-third Annual Report of the Sanitary Commissioner with the Government of India for the years 1885 and 1886.
	Surveyor General of India	General Report on the Operations of the Survey of India Department during 1885-86.
	Telegraph Department	Indian Telegraph Guide, No. XXXIV.
	W. R. Williams	Pilot's Pocket Book for 1887.
CAPE OF GOOD HOPE	Meteorological Commission	Report of the Meteorological Commission for the year 1886.
CARLSRUHE	Central Bureau für Meteorologie und Hydrographie.	Beiträze zur Hydrographie des Grossherzegthums, Baden, Erster Heft.
		Jahres-Bericht für das Jahr. 1886.
CHEMNITZ	Royal Meteorological Institute	Resultate aus den meteorologischen Beobacbtungen im Jahre 1864 to 1873.
		Jahrbuch für 1886, 1 Leifurung, Abth 1 and 2.

Presentations to the Library from the 1st April 1887 to the 31st March 1888.

Place.	Donors.	Title of Work.
CHRISTIANIA	Norwegian Meteorological Institute.	Beobachtungs-Ergebnisse der Norwigischen Polarstation Bossekop in Alten, Theil I.
		Jahrbuch für 1886.
COLOMBO	Surveyor-General of Ceylon	Administration Report, 1886, Part II, Scientific, Meteorology.
COPENHAGEN	Institut Meteorologique Danois	Bulletin Meteorologique du Nord, February 1887 to January 1888.
		Annuaire Météorologique pour l'année 1884, Part II, and 1885, Parts I and III.
	Royal Academy of Sciences	Oversigt, No. 3 of 1886, and Nos. 1 and 2 of 1837.
CORDOBA	Meteorological Office	La Variabilidad interdiurna de la Temparatura en algunos puntos de la Republica Argentina y de America del sur en general, No. IV.
		Anales de la oficina Meterologica Argentina, Tome V.
	National Academy of Sciences	Boletin de la Academia Nacional Ciencias, Tomo. IX, Entregas 1, 2, 3*a* and 4*a*, Tomo X, Entrega 1.
		Actas de la Academia Nacoinal de Ciencias en Cordoba (Republica Argentina), Tome V, Entrega Tercera.
DEHRA DUN	Editor	"Indian Forester", April 1887 to March 1888.
	Trigonometrical Branch, Survey of India.	Synopsis of the Results of the Operations of the Great Trigonometrical Survey of India, Vol. VIIIA.
		Spirit-levelled heights No. 2, Madras Presidency, Season 1885-86.
DORPAT	Dr. Karl Weihranch	Einfluss des Widerstandes auf die Pendelbewegung bie ablekenden Kräften mit Anwendung auf des Foucault'sche Pendet.
		Zwanzigiährige Mittelveerthe aus den Meteorologischen Beobachtungen 1886 bis 1885 für Dorpat.
	Observatory	Observations, September 1886 to September 1888.
		Bericht über die Ergebnisse der Beobachtungen an den Regenstation für das Jahr. 1886.
DUBLIN	Royal Dublin Society	Scientific Proceedings, Vol. V, New Series, Parts 3 to 6.
		Scientific Transactions, Vol. III, Series II, Nos. 11 to 13.
EDINBURGH	Scottish Meteorological Society	Journal, 3rd Series, No. 4.
GREENWICH	Royal Observatory	Results of Meteorological and Magnetical Observations made at the Royal Observatory, Greenwich, in the year 1885.
HAMBURGH	Deutsche Seewarte	Wetterbericht, 1st March 1887 to 29th February 1888.
		Monatsbericht, January 1886 to September 1887.
		Die Ergebnisse der Witterprognosen im Jahre 1886.
		Meteorologische Beobachtungen in Deutschland Jahrg VIII, 1885.
		Deutsche Ueberseeische Meteorologische Beobachtungen, Heft I.
HAVANNA	Real Colegio de Belen	Observaciones Magneticas y Meteorologicas, October to December 1885.
HONG-KONG	Observatory	Five-day means of the principal Meteorological Elements for 1886.
		Annual Weather Report for 1886.
		Weather Report for January to October 1887.
		Observations and Researches made at the Hong-Kong Observatory in 1886.
		Report on Information issued in 1886 concerning Typhoons.
IOWA	Dr. Gustavas Henrichs	Report of the Iowa Weather Service for 1886.
JEYPORE	Maharajah's Observatory	Annual Reports of the Jeypore Medical and Meteorological Institutions for 1886 and 1887.
LAHORE	Government of the Punjab	Report on the Meteorology of the Punjab for the year 1886-87.
	Meteorological Office	Summary of Meteorological Conditions prevailing over the Punjab during March 1887 to February 1888.
LEIPZIG	Vereins für Erdkunde	Mittheilungen des Vereins für Erdkunde zu Leipzig, 1884, 1885 and 1886.

Presentations to the Library from the 1st April 1887 to the 31st March 1888—continued.

Place.	Donors.	Title of Work.
Lisbon	Royal Academy of Sciences	Conferencia Acerca dos Infinitamente Pequenos.
		Conferencia Acerca da Circulacos da Materia.
		Jornal de Sciencias Mathematicas Physicas e Naturaes, Nos. XXX to XLIV.
London	G. J. Symons, Esq.	Symons's Monthly Meteorological Magazine, March 1887 to February 1888.
	Meteorological Office	Quarterly Weather Report, Parts II to IV of 1878, and Parts I and II of 1879.
		Monthly Weather Report, September to December 1885.
		Weekly Weather Report, Vol. III, No. 53; Vol. IV, Nos. 1 to 55.
		Quarterly summary of the weekly Weather Report, Vol. III, 4th quarter and year; Vol. IV, 1st and 2nd quarters.
		Report of the third meeting of the International Meteorological Committee, held at Paris, September 1885.
		Report of the Meteorological Council to the Royal Society for the year ending 31st March 1886.
		Hourly Readings, Parts III and IV of 1884 and Part I of 1885.
		Daily Weather Report, 1st July to 31st December 1886.
		Atlantic Weather Charts, 8th November 1882 to 14th February 1883.
		Suggestions for an international nomenclature of clouds and remarks concerning the nomenclature of clouds.
		Meteorological observations made in ships of the Russian Fleet (Nos. 52 to 54).
	Publishers	Westminister Review, January to March 1888.
	Royal Asiatic Society	Journal, Vol. XIX, Parts II to IV; Vol. XX, Part I.
	Royal Meteorological Society	Quarterly Journal, Vol. XIII, Nos. 61 to 64.
		Hints to Meteorological Observers.
		Meteorological Record, Vol. VI, Nos. 23 to 26.
	Royal Society	Proceedings, Nos. 249 to 260.
	Society of Arts	Journal, Nos. 1791 to 1842.
Madras	Government Astronomer	Results of the observations of the fixed Stars made with the meridian circle at the Government Observatory, Madras, for the years 1862 to 1864.
	Government of Madras	Manuals of the Kurnool and Coimbatore districts of the Malabar district, Vols. I and II.
		Annual Administration Report of the Forest Department, Madras Presidency, for the year 1885-86.
Madrid	Astronomical Observatory	Observaciones météorologicas efectuadas en el Real observatorio de Madrid, Anos 1865, 1866 and 1868 to 1875.
Magdeburgh	Magdeburgischen Zeitung	Jahrbuch der meteorologischen Beobachtungen, Jahrg IV, 1885.
Manila	Meteorological Observatory	Observaciones verificados, January to June 1883.
Mauritius	Observatory	Annual Report of the Director of the Royal Alfred Observatory for the year 1886.
		Mauritius Meteorological Results for 1886.
Melbourne	Observatory	Monthly record of results of observations in Meteorology, Terrestrial Magnetism, &c., taken at the Melbourne Observatory from October 1886 to October 1887.
Mexico	Observatory	Longitud del Observatorio Astronomico Nacional Mexicana.
		Anuarie Ano de 1888.
Milan	R. Osservatorio Astronomico	Publicazioni del Reale Osservatorio di Brera in Milano, No. 6; No. 7, Part II; and Nos. 27 to 31.
		Nuova triangolazioni della citta di Milano.
		Osservazioni Meteorologiche esequite nella R. Specola di Brera Annos 1882 and 1887.

Presentations to the Library from the 1st April 1887 to the 31st March 1888—continued.

Place.	Donors.	Title of Work.
Munich	Geographical Society	Jahresbericht der Geographischen Gesellschaft für 1886.
	Meteorological Central Station	Übersicht über die Witterungsverhältnisse im Konigreiche Bayern, June to August 1886 and February 1887 to January 1888.
		Beobachtungen der Meteorologischen stationen im Konigreich Bayern, Jahrgang, VIII, hefte 2 and 4, Jahrgang IX, hefte 1 to 3.
	Royal Bavarian Academy of Sciences.	Sitzungsberichte der mathematisch-physicalischen classe 1885, hefts 2 to 4; 1886, hefts 1 to 3.
		Abhandlungen der mathematisch-physicalischen, Fünfzehnter Band, Diette and Twiete Abth; Schzehnter Band, Erste Abth.
		Gedächtnisrede auf Joseph von Fraunhofer zur Feier Seines hundertsten Geburtstago.
		Gedächtnisrede auf Carl Theodor v Siebdd.
		Inhaltsuerzeichniss der Sitzungsberichte, Jahrgang 1871 to 1885.
Nagpur	Chief Commissioner, Central Provinces.	Resolution on the Revenue Administration of the Central Provinces for the years 1885-86 and 1886-87.
		Resolution on the management by Government of private Estates in the Central Provinces during the year ending 30th September 1886.
		Returns of Railway-borne Traffic for the quarters ending 31st March, 30th June, and 30th September 1887, and for the year 1886-87.
		Report on the Nagpur Experimental Farm in the Central Provinces for 1886-87.
	Sanitary Commissioner, Central Provinces.	Report of the Sanitary Commissioner, Central Provinces, for the years 1873 to 1885.
New Haven	Connecticut Academy of Arts and Sciences.	Transactions, Vol. VII, Part I.
	Yale University	Transactions of the Astronomical Observatory of Yale University, Vol. I, Part I.
New York	Observatory	Abstract of registers from Self-recording Instruments for January to December 1887.
Oxford	Radcliffe Observatory	Results of Meteorological Observations made at the Radcliffe Observatory in the year 1884.
Paris	Bureau Central Météorologique de France.	Bulletin International, 4th March 1887 to 1st March 1888.
		Bulletin Mensuel, January to November 1887.
	Meteorological Society of France	Annuaire November 1886 to September 1887.
Philadelphia	Franklin Institute.	Journal, March 1887 to February 1888.
Puebla	Meteorological Service	Boletin de Estadistica del Estado de Puebla Tomo 1, Nos. 1 to 3 and 9 to 26.
Pola	Hydrographischen Ampte	Meteorologische und Magnetische Beobachtungen, February 1887 to January 1888.
		Jahresbericht der Meteorologischen und Magnetischen für 1887.
Prague	K. K. Sternwarte	Magnetische und Meteorologische Beobachtungen im Jahre 1886.
	K. W. Zenzie	Die Meteorologie Sonne und die Wetter Prognose des Jahres 1886.
Rio de Janeiro	Imperial Observatory	Revista do observatorio, February 1887 to January 1888.
		Bulletin Astronomique et Meteorologique, December 1883.
Riposto	Osservatorio Meteorologico del R. Instituto Nautico.	Bullettino mensile, February 1887 to January 1888.
Rome	Ufficio Contrale Meteorologico Italiana.	Annali, Serie II, Vol. VI, Parts I to III.
Rousdon (Devon)	C. E. Peek, Esq.	Meteorological Observations made at the Rousdon Observatory for 1886.
Sinlangor (Malay States).	A. W. Sinclair, Esq.	Results of Meteorological Observations made in Sinlangor (Malay States), 1879 to 1884.

Presentations to the Library from the 1st April 1887 to the 31st March 1888—continued.

Place.	Donors.	Title of Work.
St. Petersburgh .	Imperial Russian Geographical Society.	Beobachtungen der Russischen Polarstation an der Leinamundung, II Theil.
		Meteorologische Beobachtungen, I and II Zeiferung.
		Beobachtungen vom Jahre 1882-83 and 1883-84.
		Beobachtungen der Russischen Polarstation auf Nawajozemlia, II Theil.
		Meteorologische Beobachtungen bearbeilet von K. Andryeff.
		Herausgegeben unter Reduction von R. Lenz.
	Physical Central Observatory .	Annalen des Physicalischen Central Observatoriums Jahrg 1885.
		Jahresbericht des Physicalischen Central Observatoriums 1869, 1873-74, 1877-78, 1879-80, 1881-82, and 1883-84.
		Correspondence Meteorologique publication trimestrielle del' administration des mines de Russie Annee 1850 to 1864.
		Compte Rende Annuel 1849, 1850 and 1852 to 1864.
		Meteorologisches Daily Bulletin 1878 to 1884.
		Ueber Auf und Zugang der Gewässer des Russischen Reiches von Rykatschen.
		Wahre Tagesmittel und tagliche variation der Temperatur an 18 stationen des Russischen Reiches von Wahlen.
		Catolog der Meteorologischen stationen in Russland und Finland von Leyst.
		Pegen Verhaltnisse des Russischen Reiches, mit Atlas.
Stonyhurst . .	College Observatory . . .	Results of Meteorological and Magnetical Observations, 1886.
Sydney . . .	H. C. Russell	Notes upon floods in Lake George.
		Notes upon the history of floods in the river Darling.
	Observatory	Results of rain and river observations made in New South Wales and part of Queensland during 1886.
		Results of Meteorological Observations made in New South Wales during 1885.
Syracuse . . .	Observatory	Osservazioni Meteorologiche Anno X, Nos. 1 to 12.
Tasmania . . .	Royal Society	Papers and Proceedings of the Royal Society of Tasmania for 1886.
Tiflis . . .	Physical Observatory . . .	Meteorologische Beobachtungen im Jahre 1885.
		Magnetische Beobachtungen in der 1884-85.
Tokio . . .	Imperial Meteorological Central Observatory.	Monthly summaries and monthly means for the year 1886, with 41 maps.
Toronto . . .	Meteorological Office . . .	Monthly Weather Review, December 1886 to December 1887.
		Report of the Meteorological Service of the Dominion of Canada for 1884.
Turin . . .	Dr. L. Camerans	Ricerche interno alle specie Italiane del Genere Gordins.
		A. Charier.—Bollettino dell' Osservatorio, Anno XXI, 1886.
	Osservatorio Astronomico dell' Universtá di Torino.	A. Charier.—Effemeridi del sole, della Luna e dei principali Pianeti calcolati per Torino in tempo medio civile di Roma per l' anno 1888.
		F. Porro.—Osservazioni delle Comete Finlay e Barnard-Hartwig all' equatoriale di Merz.
		F. Porro.—Nuove osservazione delle Comete Finlay e Barnard-Hartwig all' equatoriale di Merz.
		F. Porro.—Determinazione della latitudine della stazione astronomica di Termoli mediante passaggidi stelle al primo verticale.
		F. Porro.—Terza ed ultima serie di osservazioni delle Comete Finlay e Barnard-Hartwig all' equatoriale di Merz.
	Societa Meteorologica Italiana .	Bollettino Mensuale, January to December 1887.
		Bollettino meteorologico dell' osservatorio del R. Collegio carlo Alberto in Moncalieri, Vols. I to XII (1866 to 1877).

Presentations to the Library from the 1st April 1887 to the 31st March 1888—continued.

Place.	Donors.	Title of Work.
Turin	Societa Meteorologica Italiana	Bollettino menile, Serie II, Vols. I—III, Vol. V, No. 2; Vol. VIII, No. 1.
		Bollettino decadico, Anno XIII, Nos. 1 and 2.
Umballa	G. T Carruthers	Sun's Great Waterfall.
Upsala	Meteorological Observatory	Bulletin mensuel, Vol. XVIII, Année 1886.
Utrecht	Royal Dutch Meteorological Institute.	Nederlandsch Meteorologisch Jaarboek voor 1878, Tweede Deel 1886.
Vienna	Dr. K. Exner	Ueber die Scintillation.
	K. K. Central Anstalt für Meteorologie und Erdmagnetismus.	Wetterbericht, 21st January 1887 to 10th February 1888.
		Jahrbucher, Jahrgang 1885, Band XXII.
		Meteorologische Zeitschrift, January 1888.
	K. K. Geologische Reichsanstalt	Verhandlungen, Nos. 2 to 18 of 1887; No. 1 of 1888.
	Royal Academy of Sciences	*Dr. A. Wossmuth* und *Dr. G. A. Schillong.*—Uber eine experimentelle Bestimmung der Magnetisirungsarbeil.
		Dr. C. W. C. Fuchs.—Statistik der Erdbeben von 1865 to 1883.
		Dr. Eduard Mahler.—Astronomische Untersuchungen über in hebräischen Schriften erwbänte Finsternisse.
		Untersuchung einer im Buche, "Nahum" auf den Untergang Ninive's bezogenen Finsterniss.
		Über den Stern misri der Assyrer.
		Uber eine in einer syrischen Grabinschrift erwähnte Sonnenfinsterniss.
		Dr. Robert Schram.—Beitrag zur Hansen'schen Theorie der Sonnenfinsternisse.
		Friedrich Bidschof.—Bestimmung der Bahn des Planeten 236 Honoria.
		Bestimmung der Bahn des Kometen 1848 I.
		Dr. A. V. Waltenhofen.—Uber die Thermen von Gastein.
		Dr. Gottlieb Adler.—Uber die Energie magnetisch polarisirter Körper, nebst Anwendungen der hezüglichen Formeln insbesondere aul Quineke's Methode zur Bestimmung der Diamagnetisirungszahl.
		J. Haubner.—Uber die Linein gleicher Stromdichte auf flächenformigen Leitern.
		Dr. Max Schuster.—Resultate der Untersuchung des nach dem Schlammregen von 14 October 1885 in Klagenfurt gesammelten Staubes.
		J. Liznar.—Uber den Stand des Normalbarometers des meteorologischen Institutes in Wien gegenüber den Normalbarometern der anderen meteorologischen Centralstellen Europá's.
		Uber die 26tägige Periode der erdmagnetischen Elemente in hohen magnetischen Breiten.
		Über die 26tägige Periode der täglichen Schwankung der erdmagnetischen Elemente.
		G. V. Niesel.—Bahnbestimmung des Meteors vom 17. Juni 1885.
		Dr. *Franz Kühnert.*—Uber die definitiven Elermente des Planeten 153 Hilda.
		Fraz Exner.—Uber die Ursache und die Gesetze der atmospharischen Elektricität.
		Zur Photometrie der Sonne.
		Uber Transportable Apparate zur Beobachtung der atmospharischen Elektricitat.
		A. V. Obermayer u M. Ritter v Pichler.—Uber die Einwirkung der Entladung hochgespannter Elektricität auf feste in Luft suspendirte Theilchen.
		Uber die Entladung hochgespannter Elektricitat aus Spitzen.
		Anton Lampel.—Uber Drehschwingungen einer Kugel mit Luftwiderstand.

Presentations to the Library from the 1st April 1887 to the 31st March 1888—concluded.

Place.	Donors.	Title of Work.
VIENNA—*continued*	Royal Academy of Sciences—*continued.*	*J. Loschmidt.*—Schwingungszahlen einer elastischen Hohlkugel.
		Theodor Ritter v Oppolzer.—Bahnbestimmung des Planeten 237 Cölestina.
		Fduard Linnemann.—Austrium, ein neues metallisches Element.
		J. Hann.—Bemerkungen zur täglichen Oscillation des Barometers.
		Boltzman.—Neuer Beweis zweier Sätze über das Wärmegleichgewicht unter mehratomigen Gasmolekülen.
		Eduard Suess.—Über unterbrochene Gebirgsfaltung.
		A. Wachlowski.—Die Hägelverhaltnisse in der Bukowina.
		Constantin Freih v Ettingshausen.—Beiträge zur Kenntniss der Tertiär-flora Australiens, II folge.
		C. A. Porges.—Uber eine Inductionserscheinung.
		Ladislaus Satke.—Uber den täglichen Gang der Windgeschwindigkeit und der Windrichtung in Tarnopol.
		J. Puluj.—Objective Darstellung der wahren Gestalt einer schwingenden Saite.
		E. Lechner.—Uber Edlund's Disjunctionsströme.
		V. Laska.—Studien zur Störungstheorie.
		Anzieger, Nos. 24 of 1885 to 21 of 1886.
VIZAGAPATAM	A. V. Nursingrow, Esq.	Results of Meteorological Observations recorded at the G. V. Juggarow's Observatory, Vizagpatam, during 1886.
WASHINGTON	Chief Signal Office	Monthly Weather Review of the United States, December 1886 to August and October to December 1887.
		Summary and Review of International Meteorological Observations for December 1885 to September and November and December 1886.
		Weather Charts of the United States for 7 A.M., 1st August 1887 to 17th September and 25th September to 11th February 1888.
		Weather Charts of the United States for 7 A.M., 3 P.M., and 10 P.M., for 1st January to 31st March 1887.
		General Instructions to Observers of the Signal Office.
		Report of the Chief Signal Office, War Department, 1885, Parts I and II, 1887.
		Daily International Chart, 1st to 8th October and 1st November to 31st December 1886.
	Hydrographic Office	Pilot Chart of the North Atlantic Ocean, January to March and June and November 1886, and March 1887 to February 1888.
		West Indian Hurricanes and the law of Storms.
	Smithsonian Institution	Smithsonian Report, 1885, Part I.
	United States Geological Survey	Statement of the organization, business methods, and work of the United States Geological Survey.
WELLINGTON	Colonial Museum	Official record of the New Zealand Industrial Exhibition 1885.
ZI-KA-WEI	Observatory	L'inclinaison des vents sur l'horizon 3*e*, Note premiere, Année d'observations, 1886.
		Bulletin Mensuel, January to December 1886, and year.
		Sur les variations de temperature observee's dans les cyclones, 2*e* Note.
ZURICH	Swiss Meteorological Institute	Meteorologische Beobachtungen, October 1886 to July 1887.
		Annalen der Schweizerischen meteorologischen Central Anstalt, 1885.

Purchases for the Library.

American Journal of Science, April 1887 to February 1888.
American Meteorological Journal, Vol. IV, Nos. 1 to 9.
Andree's Hand Atlas.
Annalen der Physik und Chemie 1887, Nos. 5 to 12; 1888, Nos. 1 to 3.
Applied Mechanics. By Cotterill.
Comptes Rendus de l' Academie des Sciences, Vol. CIV, Nos. 10 to 26; Vol. CV, Nos. 1 to 26; Vol. CVI, Nos. 1 to 9; and tables of Vols. CIII and CIV.
Cartes synoptiques journalieres du temps, le Nord de l' Atlantique une partie des continents avoisinants; puliées par l'Institut Meteorologique Danois et le Deutsche Seewarte, December 1883 to May 1884.
Deutsche Rundschau für Geographie und Statistik, Vol. IX, Nos. 7 to 12; Vol. X, Nos. 1 to 6.
Dynamics for beginners. By Lock.
Elementary rigid Dynamics. By E. J. Routh.
Elementary Lessons in Electricity and Magnetism. By Silvanus Thomson.
Elementary Practical Physics, Part II. By Stewart and Gee.
Electric Transmission of Energy. By G. Kapp.
Electric Light Arithmetic. By Day.
Encyclopœdia Britannica (Ninth Edition), Vol. XXII.
Examples on Heat and Electricity. By Turner.
Geometrical Optics. By R. S. Heath.
La Nature, Nos. 720 to 771.
Mathematical Theory of Elasticity. By Ibbetson.
Nature, Nos. 907 to 958.
Nautical Astronomy and Navigation, Part I. By H. W. Jeans.
Philosophical Magazine, March 1887 to March 1888.
Practical Astronomy by Loomis.
Practical Electricity. By Ayrton.
Properties of Matter. By P. G. Tait.
Sailor's Language. By W. C. Russell.
Sailing Directions. By Heckford.
Spherical Trigonometry, Parts I and II. By Preston and M'clelland.
Text Book of Algebra, Part I. By Chrystal.
Thacker's Indian Directory for 1888.
Treatise on Nautical Astronomy. By J. Merrifield.
Vierteljahrs-Welter-Rundschau an der Hand der täglichen synoptischen Wetterkarten für den Nordatlantischen Ocean des Danischen meteorologischen Instituto und der Deutschen Seewarte, Herbst 1883, Jahrgang I, Heft I.
Vierteljahrs-Welter-Rundschau an der Hand der täglichen synoptischen Wetterkarten für den Nordatlantischen Ocean des Danischen meteorologischen Instituto und der Deutschen Seewarte, Winter 1883-84, Band I, Heft II.
Weather. By Honourable Ralph Abercromby.

Government of India Central Printing Office.—No. 34 Meteo.—20-9-88.—360.

STORAGE